ONTARIO
RESEARCH
AND
DEVELOPMENT
CHALLENGE
FUND

ONTARIO
INNOVATION
TRUST

PREMIER'S
RESEARCH
EXCELLENCE
AWARDS

A Sampling of Success Stories of Provincial Investment in University Research

PREPARED BY THE ONTARIO COUNCIL ON UNIVERSITY RESEARCH

102-03920/

A Sampling of Research Success

The following "success stories" have been compiled to illustrate the range and richness of university research supported by Ontario research funding.

The Ontario government has made a significant investment in university research in recent years through the **Ontario Research and Development Challenge Fund** (ORDCF), **the Ontario Innovation Trust** (OIT) and the **Premier's Research Excellence Awards** (PREA). These success stories show that this investment has paid off impressively. Important research has been made possible by this funding and, in turn, important results have been achieved.

Ontario research funding has made a difference to the ability of Ontario's universities to conduct leading-edge research. Ontario university research is making a difference to the competitiveness of Ontario's economy and the quality of life of Ontario citizens.

These brief accounts demonstrate the excitement and productivity of research and innovation at Ontario's universities, across the disciplines. They are indeed successes we can all celebrate.

Research Success Stories – Table of Contents

BROCK UNIVERSITY

Cool Climate Oenology and Viticulture Institute 1

Catalysis Industrial Research/Infrastructure 2

Sensory Characteristics of Ontario Wines 3

Smoking Cessation – Teens and Young Adults 4

Health and Biomechanics 5

CARLETON UNIVERSITY

Engineered Structures and New Diamond Mines 6

Alzheimers, Epilepsy and Stress: Bench to Bedside 7

Seeing the Light 8

Environmental Biology 9

UNIVERSITY OF GUELPH

Space and Advanced Life-Support Agriculture 10

Food System Biotechnology Centre 11

Innovation and Commercialization: Nanodesign 12

Premier's Research Excellence Award Winners 13

Project SOY (Soybean Opportunities for Youth) 14

LAKEHEAD UNIVERSITY

Managing Industrial Waste 15

Hands-on Training 16

Recovering the "Last of the Lost" 17

LAURENTIAN UNIVERSITY

MIRARCo and its Affiliated Centres 18

Environmental Complexity 19

Cancer Research Activity 20

Centre for Environmental Monitoring 21

McMASTER UNIVERSITY
Steel Research Centre 22
High Throughput Screening Laboratory 23
Gene Therapeutics 24
McMaster Manufacturing Research Institute 25
Supercomputing – SHARCNET 26

UNIVERSITY OF OTTAWA
Stem Cells 27
Role of Bacteria in Metal Cycling in Mining Environments 28
3-D Modeling of Neural Regeneration 29
Inhibitors of PCs and SKI-1 in Health and Disease 30
SAVANT Research Laboratories 31

QUEEN'S UNIVERSITY
High Performance Computing Aids Aircraft Design 33
Centre for Automotive Materials and Development 34
Laser Research Increases Understanding of Ozone 35
Education Research 36
Hyperpace Helmet 37

RYERSON UNIVERSITY
Business Geomatics 38
Advanced Distance Education Tools 39
Ultrasound Imaging for Cancer Therapy 40
New Drive Technologies 41

UNIVERSITY OF TORONTO
Centre for Innovation Law and Policy 42
Centre for Advanced Coating Technologies 43
Chemical Engineering and Applied Chemistry 44
Chemistry, Faculty of Arts & Science 44
University of Toronto at Mississauga 45
PREA Recipients 46

TRENT UNIVERSITY
Research Success Stories 47

UNIVERSITY OF WATERLOO
The New Bell University Laboratories 48
High Speed Automated Welding 49
Centre for Applied Cryptographic Research 50
Live Fire Research Facility 51
Research in Miniature: WATLabs 52

UNIVERSITY OF WESTERN ONTARIO
New Centre for Industrial Recycling 53
Protein Research at Western 54
System Aids Earthquake and Mineral Research 55
SHARCNET Computer Consortium 56

WILFRID LAURIER UNIVERSITY
New Transition Metal Systems 57
Combating Nausea from Chemo 58
Mapping the Human Brain 59
Spatial Analysis Lab 60
Multiple Metal Spectrometer 61

UNIVERSITY OF WINDSOR
Invasion Threats to the Great Lakes 62
Making Drinking Water Safer 63
Molecular Biogeochemistry at Windsor 64
Studying Diseases and Aging 65
New Materials Research 66

YORK UNIVERSITY
Visual-motor Neuroscience 67
CRESS Space Instrumentation Laboratory 68
Analytical Mass Spectrometry 69
Medicinally Important Compounds 70
Regulation of Genes 71

BROCK UNIVERSITY **Cool Climate Oenology and Viticulture Institute**

In June 1999, Brock University opened Inniskillin Hall, the home of the Cool Climate Oenology and Viticulture Institute (CCOVI). Supported by the **Ontario Research and Development Challenge Fund**, by grape growers and the Niagara wine industry, CCOVI brings together research, teaching and service as related to a major Ontario industry. Industry sponsors have contributed to a growing and unique facility, including CCOVI's Grape and Wine Science Library which ensures that students, researchers, and industry will have access to the accumulated knowledge in cool-climate viticulture and oenology. The **ORDCF** investment was matched by the Canada Foundation for Innovation.

CCOVI serves as a focal point for Brock's emerging biotechnology research program and its undergraduate, M.Sc. and new Ph.D. programs in Biotechnology. Key international researchers, including Dr. Vincenzo De Luca, a Tier 1 Canada Research Chair, Dr. Andy Reynolds, a NSERC Industrial Chair; Dr. Gary Pickering, Dr. Deborah Inglis and Dr. Linda Bramble have been attracted to Brock and CCOVI. Drs. De Luca and Pickering have been recruited from the United States and New Zealand, respectively. The research programs of these individuals and their students contribute significantly to our knowledge of viticulture practices on wines and their taste, ice wine production, sensory qualities of wine and the influence of selected compounds in icewines, and the economic impact of the wine industry on tourism in Ontario.

As Canada's only Honours BSc. in Oenology and Viticulture, the CCOVI undergraduate program provides a solid base in biotechnology with courses focusing on fermentation technology, viticultural practices, wine microbiology, wine analysis and sensory evaluation of wines. Graduates are educated to work in the industry or to pursue advanced degrees in any number of scientific disciplines. Because their education is strongly based in biotechnology, graduates may choose to pursue careers in areas other than oenology and viticulture.

The research, teaching and service programs of CCOVI faculty advance our scientific knowledge and contribute knowledge and technology transfer to an important Ontario cultural and agricultural industry.

Provincial Program/Ministry: Ontario Research and Development Challenge Fund

Value: $1,540,000

BROCK UNIVERSITY

Catalysis Industrial Research/Infrastructure

An **Ontario Innovation Trust** grant of $40,163, matched by the Canada Foundation for Innovation with industrial contributions, for the purchase of an Integrated Automated Parallel Synthesis System, has proven to be an essential catalyst for the research programs of Drs. Alfredo (Fred) Capretta and James McNulty in Brock's Department of Chemistry. The Automated Parallel Synthesis System is a key infrastructure component for the newly formed Institute for Molecular Catalysis in which Capretta and McNulty are central researchers. The system has given them the ability to screen new catalysts quickly and efficiently to determine the best operating conditions for a particular catalyst.

McNulty and Capretta have levered their expertise and key scientific equipment such as the Automated Parallel Synthesis System into additional external research, also supported by industry and **Materials and Manufacturing Ontario**, one of the Ontario Centres of Excellence. Two projects have been co-sponsored by MMO and Cytec Canada Inc. of Niagara Falls, a global leader in the production of hydrocarbon-based phosphines.

Dr. McNulty's MMO project focuses on the development of value-added phosphines by integrating Cytec's high-volume, low-value phosphines into chiral frameworks, Dr. McNulty's scientific expertise. Phosphines have applications in areas including germicides, algicides, surfactants (detergents) and industrial catalysts. Research results have been promising and discussions are on-going with regard to the protection and commercialization of new products.

A MMO-supported project allows Dr. Capretta to investigate the combination of Cytec phosphines with transition metals such as rhodium or palladium to develop catalysts so that reactions can occur at room temperature. Catalysts are substances that alter the speed of or make possible a chemical or biochemical reaction but remain unchanged at the end of the reaction. Routinely used in the chemical manufacturing industry, Capretta's research team is focussing on the use of phosphines in the development of highly efficient catalysts.

Provincial Program/Ministry:	MMO	Value: $32,000
	Ontario Innovation Trust	Value: $40,163
Researcher:	Drs. Alfredo Capretta and James McNulty	
Department:	Chemistry	

BROCK UNIVERSITY

Sensory Characteristics of Ontario Wines

Materials and Manufacturing Ontario recognized the special research niche of Dr. Gary Pickering, recruited by Brock University's Cool Climate Oenology and Viticulture Institute from New Zealand in the summer of 2000. A world-recognized expert in the sensory characteristics of wines, Dr. Pickering has obtained three MMO awards – two Interact and one New Faculty Award. The two Interact grants allow Dr. Pickering and his student assistants to investigate the influence of fruit ripeness on the quality of Ontario red wines. This research will assist Ontario winemakers to effectively adjust growing and processing conditions in order to optimize characteristics of a variety of wines that use Cabernet Franc, Cabernet Sauvignon and Pinot Noir grapes. A key feature of the research will be assessing the mouth feel characteristics (the sensation of the wine in the mouth), a critical component of flavour. Sensory research focuses on factors that affect the flavour profile of wines and food and involves taste-test trials with groups of panellists, ranging from highly trained wine experts to the wine consumers. The influence of genetic and physiological factors on individual differences in taste and smell perception is explored in this research.

This research is supported by Hillebrand Estates Winery and Fordas Inc., an international manufacturer of lysozyme which is used to reduce the amount of SO_2 needed to achieve microbial stability over the life of both red and white wines.

Dr. Pickering's research is conducted in Inniskillin Hall, the construction of which was supported through **ORDCF**, and in Brock's new computerized Sensory Laboratory, supported by the **Ontario Innovation Trust**. This laboratory, which features a $30,000 computerized system and high-grade lighting that mimics the quality of natural light, allows researchers and students to conduct sophisticated investigations into how grape growing and winemaking variables shape sensory characteristics in wine.

Provincial Program/Ministry:	Materials and Manufacturing Ontario Ontario Innovation Trust	
Value:	$90,000 $30,000	MMO OIT
Researcher:	Dr. Gary Pickering	
Department:	Cool Climate Oenology and Viticulture Institute	

BROCK UNIVERSITY

Smoking Cessation – Teens and Young Adults

The Ontario health care system is under tremendous stress. Smoking-related illnesses contribute significantly to health care costs. Of the one-third of university- and college-age Canadian youth who now pursue post-secondary education, nearly 40% smoke and 19% of current smokers began after they arrived on campus. To understand these risk behaviours of youth and to develop a model smoking intervention program that could be used by other universities and colleges, Dr. Kelli-an Lawrance and her research team are studying the attitudes of university- and college-aged youth toward smoking and assessing a student-led smoking cessation program, Leave the Pack Behind. The research is supported by **Ontario Ministry of Health and Long Term Care.**

Since the college- and university-age group of students are in a key transitional period in their lives, chances of altering their behaviours may be enhanced. Thus, working closely with student organizations and the Regional Niagara Public Health Department, Lawrance surveyed more than 2000 first year students about their attitudes toward smoking, what their friends think, and their perception of smoke-free policies.

The research program has begun to fill a major gap in our knowledge of the smoking behaviours of youth and young adults. Lawrance and her team have also demonstrated that while a substantial proportion of university students who smoke wish to quit, very few successfully do so on their own and fewer access community-based intervention services. Hence there is a need for an appealing, accessible smoking intervention designed for and implement by the youth themselves. Leave the Pack Behind is just such a program. It is innovative, comprehensive, uses a wide-range of interventions and strategies that address the needs of the youth themselves while contributing to our understanding of their needs and behaviours, and leads to changed behaviour.

Provincial Program/Ministry: Ontario Ministry of Health and Long-Term Care

Value: $420,000

Researcher: Dr .Kelli-an Lawrance

Department: Applied Health Sciences
Department of Community Health Sciences

BROCK UNIVERSITY

Health and Biomechanics

Falls are a leading cause of death from injury in people aged 65 and over. One of the most common causes of falls amongst older people is losing balance while standing on ladders and step-stools to reach into cupboards.

In Brock's new Biodynamics Laboratory, supported by two grants from the **Ontario Innovation Trust,** Dr. David Gabriel conducts research that will have a long-term impact on preventing injuries from falls and reducing the burden on Ontario's health care system. He is developing a training program to help mature adults regain some of the lost muscle function and help improve their balance. Gabriel's research focuses on training muscles around the ankle joint. His first challenge is to identify where he can optimize the training effect to produce long-lasting improvements in balance.

A movement disabilities project, also directed by Dr. Gabriel in the Biodynamics Laboratory, integrates research into biomechanics and neural control. The study will help physicians determine the effectiveness of various treatments for movement disorders experienced by people who suffer from Parkinson's, Multiple Sclerosis, Cerebral Palsy, strokes or spinal cord injuries.

Gabriel, who has a PhD in Biomechanics from McGill University, came to Brock in 1999 following a three post-doctoral fellowship at the Mayo Clinic.

Brock received infrastructure grants from the **Ontario Innovation Trust (OIT)** and the Canada Foundation for Innovation (CFI) to purchase motion analysis system equipment to research and develop functional outcome measures for movement disabilities in the new Biodynamics Laboratory.

Provincial Program/Ministry:	Ontario Innovation Trust and CFI
Value:	$390,000
Researcher:	Dr. David Gabriel
Department:	Department of Physical Education Faculty of Applied Health Sciences

Carleton UNIVERSITY

Engineered Structures and New Diamond Mines

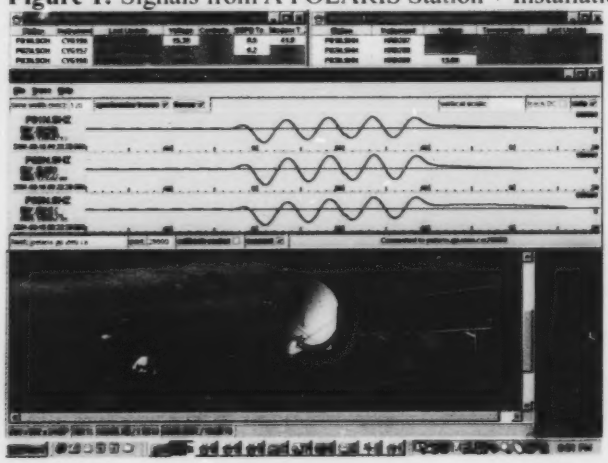
Description (http://www.polarisnet.ca/)
Funding from **ORDCF** and **OIT** in partnership with CFI have enabled a collaborative effort unrivalled in Canada bringing together Carleton University, the University of Western Ontario, UBC, the University of Manitoba and the Geological Survey of Canada. The POLARIS project involves the installation of 90 monitoring stations in Ontario, B.C., and the Northwest Territories Each station will make use of various types of equipment, such as seismographs to study ground shaking, electrode arrays to monitor variations in the earth's electromagnetic field and GPS monuments to investigate the slow, subtle ongoing deformation of the continent. Data from this equipment will be beamed to monitoring hubs in Ontario in real time via satellite, where it will be available using the Internet to scientists across Canada.

Impact
This state-of-the-art infrastructure will put scientists at Carleton and other institutions at the forefront of research on earthquake processes, and the application of special imaging techniques (similar to medical CAT-scan technology) to study the Earth's deep interior. From an HQP perspective the following impacts have been or are about to be realized:

- appointments of three geophysicists to Adjunct Professorships at Carleton
- generation of a critical mass of geophysicists working together in Ontario
- four new faculty members, three post-doctoral fellows, nine graduate students and two technicians

The POLARIS project will develop national infrastructure essential to create new economic ventures, for example diamond mines. POLARIS will benefit the health, safety and quality of life of Canadians through improved earthquake resistance of engineered structures and protection of economic infrastructure.

Figure 1: Signals from A POLARIS Station + Installation of Station in NWT



Carleton UNIVERSITY

Alzheimers, Epilepsy and Stress: Bench to Bedside

Description

Brain disorders, including psychiatric and neurological illness, affect approximately 20% of Canadians. The fiscal and social cost of these will increase dramatically in the new millennium as medical advances progressively extend the life span. The funding provided by **OIT** in partnership with CFI has initiated an explosive growth in this critical area of research.

Impact

- new models for epilepsy and stress
- a Tier I, Canada Research Chair
- enrolment in our graduate program will increase by approximately 30-40%
- attracted substantial funding nationally and internationally with the private sector
- additional partnerships with drug companies
- 3 new faculty hires in 12 months

Figure 1: The incorporation of glucose which clearly defines the structures of the brain that are actively using glucose during epileptic seizures

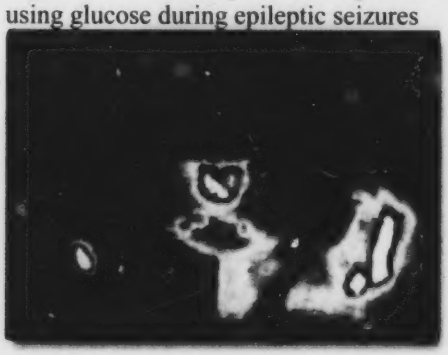


Figure 2: A microarray gene chip analysis shown in this figure compares Gene expression in rats with differing proclivity to epileptic seizures

Carleton UNIVERSITY

Seeing the Light

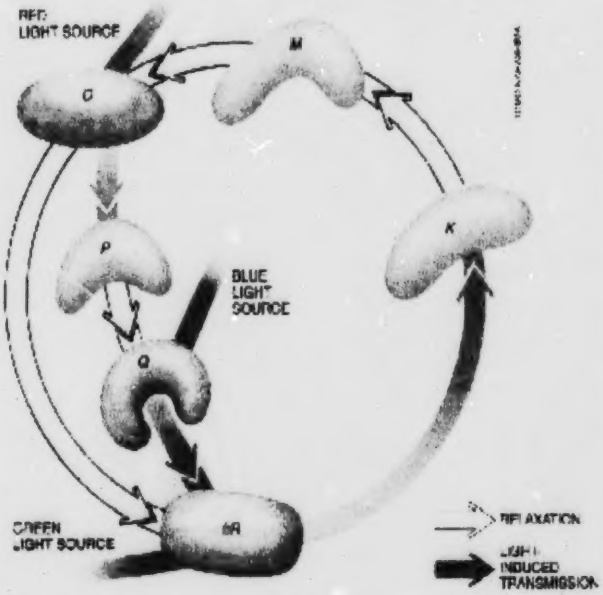
Description

Funding in the area of emerging and smart materials has catalyzed the creation of a photonics research centre at Carleton. Investment by the Ontario government through **OIT** and **ORDCF** has established Carleton as a premier facility for a vertically integrated approach to photonics research from new polymer materials to integrated systems engineering. Acquisition of infrastructure for research has led to the hiring of several HQPs, notably from Asia and the US and a new start-up company in the university. This has also resulted in attracting local industries to Carleton including two start-ups that are using the facilities to reduce production time of prototype devices and provide finances for graduate students. It has also enabled increased collaboration between Carleton, University of Ottawa, the NRC and CRC.

Impact

- approximately 10 new graduate students in this area as a result of provincial funding
- 1 new start-up company has emerged (www.twlinksinc.com)
- three start-up photonic companies are using our facilities

Figure 1: Photocycle for Bacterial Memory Storage



Carleton UNIVERSITY

Environmental Biology

Description

Canadians are increasingly concerned about the effects of technological development on the integrity of their natural environment. Carleton has recently completed construction of new biological facilities. **PREA** and **OIT** have enabled us to incorporate critical infrastructure into this facility and to attract numerous graduate students and post-doctoral fellows in areas such as parasitology, landscape ecology and plant genetics.

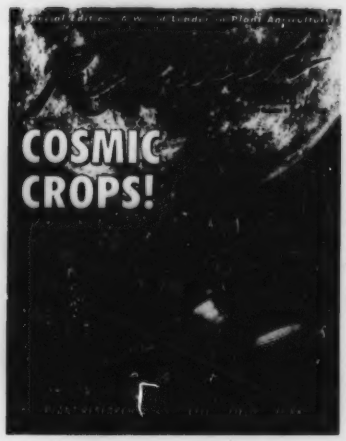
Impact

- the National Wildlife Research Centre, a research division of the Environment Canada is moving its research facilities to Carleton University
- approximately 4 new graduate students in this area as a result of provincial funding
- 3 PREAs
- 1 Canada Research Chair
- 2 new faculty positions in environmental genomics and evolutionary biology

Figure 1: Thorax of an Enallagma damselfly parasitized with Arrenurus mites

UNIVERSITY of GUELPH

Space and Advanced Life-Support Agriculture



Gaining a better understanding of how to grow food in space is the key to any bid to send humans on extended space missions. To that end, University of Guelph researchers have developed a facility for studying the growth of plants in space. The research, led by Dr. Mike Dixon in the Department of Plant Agriculture, is unique in Canada. The new facility will help humans find a way to live away from earth. It is also leading to ways of improving air quality in work environments.

During long-term missions, such as the construction of a lunar or Mars observatory, the needs of the crew can be met only by developing self-sustaining, renewable life-support systems based on plants and micro-organisms. Dr. Dixon is working with colleagues at the U.S. National Aeronautical Space Agency (NASA) where he's testing scientific instruments and methods that measure how plants respond in environments similar to that of space travel, where the atmospheric pressure varies. Practical guidelines will be established for applying these techniques on the International Space Station and in greenhouses designed for growing plants on Mars.

Central to this work on variable-pressure growth is the University of Guelph's new $7.9-million Controlled Environment Systems Research Facility. The facility, which is the most sophisticated and unique in the field of advanced life support in the world, will eventually contain 14 of the plant science world's most advanced hypobaric (reduced atmospheric pressure) chambers. Funding from the **Ontario Innovation Trust** made construction of this facility possible, and is enabling Ontario scientists to be key participants in what will be some of this century's most challenging biological work.

The facility is also used for additional studies on indoor air biofiltration in collaboration with the Northern Centre for Advanced Technology to develop applications in underground environments for the improvement of air quality in mines. A spin-off company has also formed called Air Quality Solutions Inc., which is specializing in the development of "living walls" for large buildings. This work has received additional support from **CRESTech, the Centre for Research in Earth and Space Technology, one of the Ontario Centres of Excellence**.

UNIVERSITY of GUELPH

Food System Biotechnology Centre

The Food System Biotechnology Centre (FSBC) was created by a three-way partnership between the University of Guelph, the **Ontario Research and Development Challenge Fund** (ORDCF) and private industry. The aim of the Centre is to create a University-wide consortium of researchers working in the various aspects of biotechnology as it relates to food production. Several success stories stem from the ORDCF's initial investment of $6.2 million.

One of those success stories is the "**Enviropig**," which is addressing a major source of a pollutant that threatens fish and aquatic life in rivers, lakes and streams. The Enviropig is a transgenic pig, now in its third generation, that has been engineered to express a gene in its saliva to help it digest organic phosphorus. Expression of this gene allows the pig to digest virtually all of the essential nutrient phosphorus present in its diet (a non-engineered pig can digest only 30 to 50 per cent). Absorption of the phosphorus by the pig reduces the environment-polluting phosphate levels in its manure by 60 to 70 per cent. While reducing the smell of swine feces – and its hazardous environmental impact – was the main objective of the research, Drs. Cecil Forsberg (pictured to the right at top) and John Phillips (pictured to the right at bottom) are finding additional benefits such as improved utilization of minerals, proteins and starches in the animals' diet and the elimination of the need for phosphorus dietary supplements for optimal development. The Enviropig project has been funded in partnership with Ontario Pork.

New innovations in plant biotechnology are allowing researchers such as Dr. Christopher Hall to develop plants with industrial applications. Dr. Hall is developing "plantibodies" (antibodies produced in plants) that can then be incorporated into food packaging material to alert the consumer that there is a pathogen such as *Salmonella* or *E. coli* present on the product. This can benefit not only the consumer or end user, but primary producers as well. Dr. Hall's work has been funded in partnership with Mississauga-based Toxin Alert Inc.

Biotechnology can stir up ethical debate. Dr. David Castle explores the ethical issues surrounding biotech food regulation and consumer acceptance. By focusing Dr. Castle's work on the food biotechnology area, the University of Guelph has added a new dimension to its study of food, consumer and environmental safety. Dr. Castle's work is being funded by the FSBC and Genome Canada.

The Life-Science Economy

UNIVERSITY of GUELPH

Innovation and Commercialization: SignalGene-Nanodesign

SignalGene

SignalGene-Nanodesign is a computerized drug design and discovery company, located in the University of Guelph Research Park. It is the brainchild of University of Guelph environmental biology professor Dr. Jonathan Schmidt.

Dr. Schmidt developed SignalGene-Nanodesign's computer-based molecular modeling technology to safely and cost-effectively identify and generate chemical compounds for use in pharmaceuticals. This new, rational approach to designing drugs makes a chemical to the desired specifications and is intended to increase chances of success in clinical development.

In 1994, The University of Guelph founded Guelph University Alumni Research and Development (GUARD) Inc., an arm's length company to license platform or core technologies and take them a step further.

GUARD took on Nanodesign's molecular modeling technology as one of its initial projects, until Nanodesign incorporated in 1997 and sublicensed the use of the technology from GUARD. The company continues its developmental work today as a subsidiary of Montreal-based Signal Gene (TSE- SGI), which bought Nanodesign last summer for $15 million.

The success story of SignalGene-Nanodesign is one of many Guelph research initiatives on health-related issues within the agri-food sector, which dominates about 75 per cent of the University's research funding.

With the support of the Ontario **Ministry of Energy, Science and Technology's Research Performance Fund**, the University of Guelph is strengthening the role of its Business Development Office and achieving measurable results. In 2001, the University recorded 117 invention disclosures, compared with 21 in 1998. Research contracts have also increased, from 160 in 1998 to 336 in 2001, with a total value of $16 million. The University successfully negotiated 30 licence agreements, with associated annual royalty revenue, in 2001. Guelph's number of patents is also rising: it currently holds 75 and has 143 applications in progress.

UNIVERSITY of GUELPH

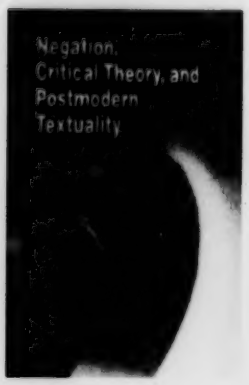
Premier's Research Excellence Award Winners

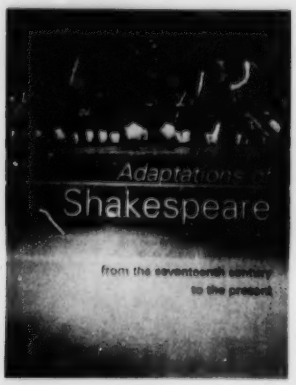
Fifteen young University of Guelph researchers have won prestigious **Premier's Research Excellence Awards (PREA)** since the awards were created in 1998. Their scope of research spans physical and chemical sciences, life sciences and the arts. To date, the total value of PREAs to researchers at the University of Guelph stands at $2.25 million.

The most recent PREA recipients are Drs. Eric Poisson, Physics; John Klironomos, Botany; Kees De Lange, Animal and Poultry Science; Yoshi Mine, Food Science; Beren Robinson and Elizabeth Boulding, Zoology; Dev Mangroo, Chemistry and Biochemistry; and Daniel Fischlin, School of Literature and Performance Studies in English.

In addition to being the first PREA winner from the arts at Guelph, Dr. Fischlin has been awarded an Ontario Confederation of University Faculty Associations Teaching Award for his commitment to excellence in teaching. He is also the coordinator of a new PhD program coming on line in his department.

Dr. Fischlin's research project entitled "Canadian Adaptations of Shakespeare" has already generated the first of three important new works. This first work is a critical book examining the nature of Canadian adaptive practices in relation to the country's theatrical history and in relation to Canada's emergence as a nation-state. He has also produced the first anthology of Shakespeare adaptations in Canada from the earliest known through to the present, including aboriginal, African-Canadian and Québécois productions, as well as those from Atlantic and Western Canada.





UNIVERSITY of GUELPH

Project SOY (Soybean Opportunities for Youth)

Project SOY is an annual contest that harnesses students' creative power to develop new products and marketing strategies for soybeans. By participating in Project SOY, students gain practical research, development and marketing skills while establishing links with industry. The ultimate objective of the contest is to increase awareness of the diverse uses and markets for Ontario soybeans, while highlighting student research and demonstrating the soybean industry's dedication to producers and the public.

Since the project's inception, students have created more than 35 new products ranging from novel food products to industrial, agricultural and veterinary applications. Some student teams are working towards protecting, patenting and commercializing their ideas in partnership with the University of Guelph's Business Development Office.

An edible, biodegradable, soy-based food packaging tray that will reduce landfill waste is just one of the many innovations developed by students participating in Project SOY. Engineering student Eugene Mohareb invented the edible packaging with former students Phuong Nguyen and Marc-Antoine Joly. He is pictured here with Project SOY student coordinator Erinn White who is holding the soy-based packaging tray.

Project SOY is the brainchild of Guelph alumnus Peter Hannam, President of First Line Seeds Ltd. Mr. Hannam has also donated $1 million to promote new and innovative uses for soybeans through the Hannam Soybean Utilization Fund (HSUP). Student participants in Project SOY who want to advance their products to the commercialization stage can now apply to the HSUP for assistance.

Lakehead
UNIVERSITY

Managing Industrial Waste

Dr. Lionel Catalan (right) – Lakehead's Canada Research Chair in Industrial Waste Management and Site Remediation – is examining how to reduce the environmental impact of wastes produced by the natural resource industries through advances in prediction methods, treatment processes and design of disposal sites.

Since his arrival at Lakehead University in 1999, Dr. Lionel Catalan has established a new laboratory devoted to research in industrial waste management and environmental remediation. He has also attracted close to a million dollars in research funding from various sources, including the Canada Foundation for Innovation, the **Ontario Innovation Trust**, the Canada Research Chairs Program, the Natural Sciences and Engineering Research Council and industrial partners.

Dr. Catalan's research currently focuses on three areas: mine waste management; treatment of industrial wastes; and remediation of hydrocarbon-contaminated soil.

"Research into innovative methods for managing industrial wastes is critical for maintaining and improving the competitiveness of Canada's natural resources sector," says Catalan.

"While the mining and pulp and paper industries play key roles in the economy of Northern Ontario, these sectors also generate large quantities of industrial wastes. Treating and storing the wastes is expensive. Research can help in reducing the costs by developing safe and economical waste treatment and storage methods. Companies that are proactive in supporting and applying waste management research increase their competitiveness and demonstrate that they care for the environment."

Northern Ontario's long history of mining has left numerous abandoned tailings areas that release contaminants in the rivers, lakes, and groundwater around them. Dr. Catalan is developing and testing new methods for neutralizing the sources of this contamination. He is also collaborating with local pulp and paper producers to find beneficial uses for some of their wastes. For example, it may be possible to use alkaline wastes from pulp mills as reagents to treat acid mine tailings. There are numerous advantages to this, such as reducing the need for landfills and decreasing waste treatment costs. However, industry and government regulating agencies will only embrace these innovative alternatives when researchers like Dr. Catalan have demonstrated that they are safe and effective in the long term.

Lakehead
UNIVERSITY

Hands-on Training

"Students leave Lakehead with hands-on training and operating experience on sophisticated research equipment – such as the Nuclear Magnetic Resonance (NMR) – that would be more difficult for them to receive at large universities," says Dr. Christine Gottardo, Professor of Chemistry at Lakehead University.

Dr. Gottardo is one of the many faculty members at Lakehead making use of the renewed Nuclear Magnetic Resonance Facility, made possible with funding provided by the Canada Foundation for Innovation and **ORDCF**.

NMR spectroscopy is a method of molecular analysis that is essential to modern chemical research. The NMR facility supports a number of research programs with direct and indirect application to industry, including Bowater Pulp and Paper Canada Inc. – Thunder Bay Operations, one of the largest kraft pulp and newsprint mills in North America.

The renewed NMR facility is an essential component to many other faculty members in the Department of Chemistry including:

- Dr. Stephen Kinrade, a leading figure internationally in the fields of aqueous silicate chemistry and silcon-29 NMR;
- Dr. Neil Weir who is widely known for his work on polymer degradation as well as on the photochemistry of paper yellowing; and
- Dr. David Holah whose research in organometallic chemistry has resulted in long-standing collaborations with groups throughout North America.

Having the new NMR facility ensures that Lakehead University maintains its positive record of research and postgraduate training in Northwestern Ontario.

Lakehead
UNIVERSITY

Recovering the "Last of the Lost"

DNA analysis is the key to identifying victims of the R.M.S. Titanic Disaster who lay buried in a Halifax cemetery. The research team is being led by Dr. Ryan Parr (right) who is working in conjunction with Lakehead University's renowned Paleo-DNA Laboratory, described by Co-Director Dr. El Molto (left) as "the best facility in Canada primarily dedicated to the extraction, amplification and analysis of ancient DNA."

Since its founding in 1996, Lakehead's Paleo-DNA Lab has combined state-of-the-art equipment and staff with special skills in handling ancient DNA. The Laboratory has been a pioneer in the application of modern molecular genetic techniques and technologies to the study of ancient DNA in both human and animal remains.

In June 2001, the Lab moved to a newly renovated space in Thunder Bay's Northwestern Ontario Technology Centre. The opening coincided with the conclusion of a two-and-a-half week internship for 20 qualified advanced undergraduate and master's level students interested in working in the growing field of DNA research.

Lakehead's Paleo-DNA Lab has developed special expertise in extracting and recovering DNA from bone samples. The primary research project is a world-class study arising from a large collection of skeletal remains from the Dakhleh Oasis, Egypt. The Lab is also involved in studies of the ancient Nubian peoples of Kerma and the ancient Chinese of Anyang.

The Titanic project to identify victims at the request of surviving family members has been attracting international media attention. This research involved the partial exhumations of three unidentified bodies buried in a Halifax cemetery. DNA from one corpse will undergo analysis to compare samples from possible family members.

Lakehead's Paleo-DNA Laboratory is funded primarily by the Northern Ontario Heritage Fund Corporation, the Canada Foundation for Innovation, **the Ontario Research and Development Challenge Fund**, the **Ontario Innovation Trust**, and Lakehead University.

Laurentian
UNIVERSITY • UNIVERSITÉ
Laurentienne

MIRARCo and its Affiliated Centres

MIRARCo, Laurentian University's Mining Research Corporation, and its affiliated Mining Research Centres have used **ORDCF** funds to train and develop a considerable number of highly qualified technicians and graduate students who go on to work in the mining, mineral exploration, tailings remediation, and environmental monitoring sectors. A state of the art facility for visualizing data in multi-dimensions will provide new insights for researchers in the mining and mineral exploration sectors in particular.

Over a two-year period, the Centres have secured more than **20 new projects** that contribute significantly to sustainable mining, resulting in millions of dollars in project-related revenues. **Upcoming project revenues are expected to exceed $6 million.** These funds are reinvested into the community, through suppliers, infrastructure, equipment, and human resources.

Funding was provided to MIRARCo by **ORDCF** for the Centre for Environmental Monitoring (CEM) and the Centre for Mining Technology (CMT) and from **CFI-OIT** for the Centre for Integrated Monitoring Technology (CimTec).

GRC GEOMECHANICS RESEARCH CENTRE

mirarco MINING INNOVATION

CIMMER MINING AND MINING ENVIRONMENT RESEARCH

MERC MINERAL EXPLORATION RESEARCH CENTRE

ELRFS ELLIOT LAKE RESEARCH FIELD STATION

CMT MINING TECHNOLOGY

CIMTEC MONITORING TECHNOLOGY

CEM ENVIRONMENTAL MONITORING

Laurentian
UNIVERSITY•UNIVERSITÉ
Laurentienne

Environmental Complexity

Dr. Madhur Anand, a biology professor at Laurentian has received funding from **OIT ($73,000)** in conjunction with CFI's New Opportunities program (total funding $184,210) for her research project entitled "Modelling recovery pathways: a complex systems approach to studying perturbed ecosystems".

This funding is being used by Dr. Anand to study ecosystem recovery using cutting-edge ecological theory combined with unique long-term monitoring of industrially damaged terrestrial ecosystems in the Sudbury area.

The project involves collaboration with a team of researchers at Laurentian making up the newly formed **Canadian Shield Environmental Research Network** (CSERN). This award helps Laurentian University provide the state-of-the-art in research facilities for new faculty members like Dr. Anand, a world-class researcher and recently appointed Canada Research Chair in Biocomplexity of the Environment.

Laurentian
UNIVERSITY•UNIVERSITÉ
Laurentienne

Cancer Research Activity

With funding from the **ORDCF,** Laurentian University has developed a Chair in Cancer Research Position in co-operation with the nearby Northeastern Ontario Regional Cancer Centre. The Chair's major responsibilities are to direct the research efforts of a highly successful tumour biology research program at the Northeastern Ontario Regional Cancer Centre (NEORCC), to further expand current research programs and infrastructure, to use ORDCF funds as "leverage" money to obtain additional funding for personnel and infrastructure, and to establish the first stand alone Ph.D. program at Laurentian University.

Despite Dr. Parissenti's being Chair for only one and a quarter years, funding from the ORDCF has already made a very strong impact on research efforts locally. With respect to the goals/responsibilities of the Chair, the following achievements have been made or are in process:

Funding from **ORDCF** has purchased equipment (cDNA microarray scanner, phosphorimager, fluorometer, and a fast protein liquid chromatography system (FPLC) housed at Laurentian University and NEORCC. This acquisition of highly valuable research equipment has enabled the researchers to maintain state-of-the-art research laboratories and to solidify a strong research base in Sudbury. The group has identified a series of novel genes related to drug resistance in breast cancer chemotherapy, and thus may help predict responsiveness to chemotherapy drugs in breast cancer patients. This is to be assessed in a national clinical trial (MA-22) by the National Cancer Institute of Canada Clinical Trials Group.

The NEORCC-LU group has also identified important proteins in the blood of breast cancer patients that appear to predict survival times after high dose chemotherapy. Screening of the above-described genes, which correlate with drug resistance in breast tumour cells, may have the potential to become standard practice in "tailoring" chemotherapy to breast cancer patients. As such, this intellectual property may be of significant commercial value and a provisional patent for this approach is being sought by NEORCC.

The funding is being used to supplement the salary and research program of a highly successful new researcher recruited from the U.S. The ORDCF monies were instrumental in attracting this researcher back to Canada. This is the first of three new researchers that the team will be able to hire due to ORDCF funds.

Funds have also been used as leverage money to secure additional research support from other sources. **Since the ORDCF grant was awarded in 1999, $1,961,562 in external operating and equipment research grants have been awarded (in addition to the ORDCF grant of $1,553,646)!** These include grants from the R. Samuel McLaughlin Foundation, the Canadian Institutes of Health Research, the Natural Sciences and Engineering Research Council, the Heart and Stroke Foundation, the **Premier's Research Excellence Award Fund,** and Aventis Pharmaceuticals. Many funding agencies prefer to award grants to projects where "matching" contributions from other partners such as the ORDCF have been secured. Funding from the ORDCF is expected to last until September of 2005.

Laurentian
UNIVERSITY•UNIVERSITÉ
Laurentienne

Centre for Environmental Monitoring

This research centre, founded in 2000 **with funding from the Ontario Research and Development Challenge Fund**, conducts interdisciplinary research that uses the superb natural laboratories of the region to study the effects of emissions and abatement technologies on affected and near-pristine land systems, as well as human health issues through studies of water quality. The goal is to bring together in one unit key researcher in disciplines allied to ecosystem management such as terrestrial and aquatic biology, ecology, environmental chemistry and toxicology, earth sciences, radiation biology and others and to move to a holistic focus on ecosystem management. The CEM also continues the tradition of working with industry and community partners to create and develop new technologies to meet environmental regulations and preserve ecosystems.

One developing core focus of CEM researchers is to develop models for the display of spatial data within an immersive virtual reality environment using the newly commissioned Virtual Reality Laboratory at the Centre for Integrated Monitoring Technology (CIMTec). The VRL will allow the development of predictive modeling scenarios to explore effects of impending climatic warming events, or of pollution gradients at varying scales.

Dr. G.A. Spiers is the **Chair of Environmental Monitoring** at Laurentian University cross-appointed in the Departments of Chemistry and Earth Sciences and **Director of the Centre for Environmental Monitoring** with MIRARCo. He has 25 years of research and facilities management experience in academic, government and commercial laboratory environments.

Dr. Andriy Cheburkin, formerly Head of the Physical Methods Research Laboratory, Institute of Geological Sciences, Ukrainian Academy of Sciences, is a key member of the research team. His broad knowledge of instrumental analytical chemistry, electronics, data communications and computer programming will be critical to the development of monitoring technologies under harsh environmental conditions. His current research uses isotopic analysis to define source-sink relationships for industrial metal contaminants, and also to date contamination events. He is the designer of a specialized low-background XRF analyzer for fine particle analysis.

Dr. David Pearson, professor of Geology at Laurentian University is also the Co-ordinator of its Environmental Sciences programme and **Chair of CSERN**. His research interests include old growth forest values, impact on heavy metals in urban watersheds, restoration and recovery of industrially impacted ecosystems. Most recently his research has focused on characterizing sediment and water chemistry to develop remediation plans for industry-polluted lakes. **Founding Director of Science North**, he is a well-known communicator of science and environmentalist. He has most recently been involved as a panel member of the Environmental Review Tribunal hearings on the Niagara Escarpment Plan.

McMaster University

Steel Research Centre

McMaster's Steel Research Centre has put the University in the business of innovation as well as instruction. The $10 million centre – one of only three university-based steel centres in North America – is partnering with industry to ensure that Canada's steelmakers continue to lead the world in innovation, and that highly qualified Canadian workers are prepared to meet future challenges. Indeed, today's academic testing ground is tomorrow's industry proving ground.

Dr. Gord Irons (front row, second from left), along with his colleagues, research technicians and graduate students from McMaster's Steel Research Centre.

This is not new territory for McMaster. As Hamilton is the centre of Canada's steel industry, McMaster's focus on steel research has evolved from a long established university-industry cooperation. The Steel Research Centre realizes a meeting between steel industry goals, aggressive government leadership supporting wealth creation through science, and McMaster's own identification of science-based manufacturing as an area of strategic importance.

Dr. Gord Irons, the Centre's first director who holds the Dofasco/NSERC chair in ferrous metallurgy and is a world expert in steel making, says the institute uses its fundamental-research expertise to improve existing processes and develop new ones. And the Centre's reach is ambitious. Research areas include seeking better output and efficiency in steel mills, improving recycled use of waste materials, looking at technologies to cut emissions and helping to maintain steel's competitive edge in the changing marketplace.

The Centre has been instrumental in the recruitment of internationally renowned steel making experts.

Funding Partners:

The Ontario Research & Development Challenge Fund	**$3 million**
Centre Members – Dofaso, Stelco, Iron Ore Company of Canada, Slater Steel, Ipsco, BHP, Noranda, Air Liquide, Hatch Associates	$3.5 million

McMaster University

High Throughput Screening Laboratory

While the discovery of antibiotics half a century ago was a milestone victory over infectious diseases, over time some pathogens have become virtually immune to the standard medical weapons. Figuring out how the microbes develop this resistance and how scientists might engineer more effective infection-fighters is the research focus of biochemist and Canada Research Chair Dr. Gerry Wright, a **Premier's Research Excellence Award** winner and **Polanyi Prize** recipient.

And in order to help him further his studies, McMaster has recently opened the $15 million McMaster High Throughput Screening Laboratory (HTS), a small molecule screening and research facility – the first of its kind in a academic setting in Canada and one of only a very few worldwide. The lab's director, biochemist and Canada Research Chair Dr. Eric Brown, who was repatriated from the private sector in the United States, says the state-of-the-art robotics run parallel reactions in high throughput (in the order of thousands per day) to discover new molecules and processes that have the potential to be used in drug discovery programs. It is linked conceptually and directly with combinatorial chemistry labs at the University of Toronto and York University.

Recognizing the significant strategic importance of this area of research, McMaster is working to build a critical mass of researchers with interests in drug discovery and disease. Drs. Wright and Brown, along with chemist Dr. John Brennan, a **PREA** recipient and Canada Research Chairholder, are considered by their peers to be world leaders in their fields. The combination of their research, their training of graduate students – the next generation of biotechnology researchers – and the new HTS facility, means McMaster's expertise will be a tremendous resource to the province and the country.

The HTS project began with a **$5 million** investment by the **Ontario Research & Development Challenge Fund** as part of a province-wide initiative in genomics. In turn, this was matched with significant investments by private sector partners, most notably, Beckman Coulter, Crompton Corporation (formerly Uniroyal) and Néokimia. In addition to the HTS, there has been a massive investment in both chemistry and biochemistry at McMaster (Biomolecular Interactions Initiative) through the Canada Foundation for Innovation and the **Ontario Innovation Trust** with some **$13 million** in equipment grants and New Opportunities funding.

Funding Partners:

Premier's Research Excellence Awards	**$ 200,000**
Ontario Research & Development Challenge Fund	**$ 5.0 million**
Ontario Innovation Trust	**$ 6.5 million**
Canada Foundation for Innovation	$ 6.5 million
Industry Partners	$ 5.0 million

Canada's Minister of Industry, the Honourable Brian Tobin (front), and Hamilton West MP Stan Keyes tour McMaster's High Throughput Screening facility - the first of its kind in Canada.

McMaster University

Gene Therapeutics

While the science of gene therapy has a considerable distance to go for the development of novel transfer systems, the practice of gene therapy in Ontario is at the cutting edge. Many researchers have predicted that gene therapeutics – the use of the gene as a drug – will revolutionize health care, leading to advances in the prevention, diagnosis and treatment of common diseases.

Dr. Jack Gauldie

McMaster is well positioned to take its place at the forefront of this new technology. With leading experts like Dr. Jack Gauldie, a world expert in the areas of cytokine biology, inflammation and immunology, and Dr. Frank Graham, one of the world's most accomplished researchers in molecular virology, co-directing McMaster's new Centre for Gene Therapeutics and Immune Modulation (funded by the **Ontario Research & Development Challenge Fund**), we are on course to take a leadership role in the development of gene transfer technologies.

Dr. Frank Graham

The Centre is focused on developing novel cures for cancer, inflammatory diseases and infectious diseases using state-of-the-art gene transfer technology coupled with the most recent information derived from the application of genomics. Currently, a proposal is being put forward to the federal government's Therapeutic Product Program (TPP) to undertake clinical trials in breast cancer which should begin in mid-2002.

The Centre is just one part of McMaster's larger plan to build a Centre for Molecular Medicine and Health. With firm commitments from the Canada Foundation for Innovation and the **Ontario Innovation Trust**, the new Centre is expected to be completed by the Spring of 2004. And the potential spin offs are enormous – the most profound, of course, will be the impact on the quality of life for the millions of Canadians who suffer from disease.

Funding Partners:

The Ontario Research & Development Challenge Fund	**$ 6.7 million**
The Ontario Innovation Trust	**$ 7.5 million**
The Canada Foundation for Innovation	$ 7.5 million

McMaster University

McMaster Manufacturing Research Institute

Two years after the **Province of Ontario**, the federal government, a number of leading industrial partners and McMaster University committed $19 million to create the McMaster Manufacturing Research Institute (MMRI), the facility opened for business. Since opening in the Spring of 2001, the McMaster Manufacturing Research Institute – unique to Canada and North America – is having a direct impact on the manufacturing industry. Through the Institute, McMaster engineers are conducting industry-relevant research impacting the polymer industry, the automotive and aerospace industries and the tool, die and mold industry.

Industry and government officials, media, faculty, staff and students check out the new equipment at the official opening of the MMRI.

The Institute's director Dr. Andy Hrymak says the 15,000 sq. ft. facility was designed to meet the sophisticated research and development needs of leading manufacturers and credits industry and government support as key factors in the Institute's creation. The MMRI gives researchers the ability to develop new products and commercialize new technologies, products and services and bring them to market right here in Ontario. And, just as importantly, it provides undergraduate and graduate students a tremendous opportunity to apply their knowledge to industry-relevant R&D issues.

Focusing on six main areas of research in manufacturing engineering, namely machining systems, metal forming, polymer processing, robotics, sensors and control – the Institute has become a powerful tool in the transfer of new technologies. For instance, in a partnership with **Materials & Manufacturing Ontario**, Cobra Machine Tool and Ford USA, MMRI researchers, in cooperation with Cobra and Ford engineers, are developing a special machine tool called a mill/grind which, upon completion, will be used by Ford USA for the production of automotive components. The mill/grind will have the capability to both mill and grind material in a single pass; reducing the number of machines, improving productivity and making tighter tolerance finishes.

Funding Partners:

The Ontario Research & Development Challenge Fund	**$ 3.30 million**
The Ontario Innovation Trust	**$ 3.64 million**
Canada Foundation for Innovation	$ 3.64 million
Industry partners – Orlick Industries, Siemens Westinghouse, GM Canada, Cobra Machine Tool, Husky Injection Molding System, Liburdi Engineering and Silicon Graphics.	$ 3.42 million

McMaster University

Supercomputing – SHARCNET

The quest of **Premier's Research Excellence Award** recipient and astrophysicist Dr. Hugh Couchman to understand how galaxies were formed billions of years ago is about to get a little easier. McMaster has joined forces with a handful of Ontario universities and colleges to create SHARCNET – a $42 million supercomputing network that will give Couchman and his colleagues a much faster and more powerful tool to carry out research.

SHARCNET, which stands for Shared Hierarchical Academic Research Computer Network, provides computational capabilities for researchers in science, engineering, medicine and business who need it to tackle difficult problems. SHARCNET represents 27 per cent of all the supercomputing power available in Canada and half of the supercomputing capability operated by Canadian universities. McMaster, along with Western and Guelph, is one of the network's primary centres. All three have recently built supercomputers that rank among the top 400 in the world.

Astrophysicists Dr. Hugh Couchman (left) and Dr. Erik Sorensen with McMaster's newest supercomputer.

As a result of having this supercomputing technology right in Ontario, researchers will now be able to conduct their work here rather than going to the United States or abroad as they've had to do in the past. It is also a huge drawing card in terms of recruiting the best people to Ontario, the best teachers and the best graduate students – people like Dr. Erik Sorensen, a computational physicist and the first recipient of a SHARCNET research chair, who McMaster recruited from the University of Toulouse in France.

McMaster's Beowulf cluster, as it's called, is made up of 28 blocks with four computer processors each, for a total power of 112 processors. When it's running at top speed, the supercomputer can perform 120 billion calculations per second.

Funding Partners:

PREA (3 McMaster PREA researchers)	**$ 300,000**
Ontario Research & Development Challenge Fund	**$ 8.4 million**
Ontario Innovation Trust	**$ 6.6 million**
Canada Foundation for Innovation	$ 6.6 million
Industry (Compaq Canada – $7 million)	$11.0 million

Université d'
University of
Ottawa

Stem Cells

New Strategies for Improving the Health of the Next Generation

Of all the unsolved mysteries in the world, the workings of the human body are still fascinating and not completely understood. In a laboratory at the University of Ottawa, Michael Rudnicki is playing the role of detective, tracking down the genes that control the function of cells that are responsible for the regeneration of tissue, so called stem cells.

Stem cells are found in almost all adult tissues including bone marrow, liver, brain, and muscle. It was previously believed that adult stem cells were specialized to only give rise to a limited number of cell types depending on the particular tissue. However, within the last year it has become clear that adult stem cells can give rise to many different cell types. For example, transplanted bone marrow stem cells can give rise to nerve cells, liver cells, brain cells and muscle cells. Similarly, transplanted muscle and brain stem cells can give rise to blood cells as well as other cell types. Stem cells that have the ability to make many different types of cells are called pluripotential. Dr. Rudnicki's laboratory has identified a gene that controls the mechanism, or "switch", by which pluripotent stem cells give rise to specialized stem cells that then form a particular cell type. In other words, by activating this switch, the stem cell is given specific instructions that regulate what they become.

Dr. Michael Rudnicki

Understanding the way genes control the growth and repair of tissue leads directly to the knowledge doctors need when they are treating patients with degenerative diseases. For example, Rudnicki's research will provide insights into the biology of muscle regeneration, leading to new ways of intervening to encourage regeneration after injury or illness.

Rudnicki's previous research identified differences in some of these genes and catalogued what they do, using mice models. The ORDCF award permitted the recruitment of Dr. Rudnicki allowing him to continue to explore the functions of these genes. Making these connections will solve fundamental mysteries about the development of vertebrates and tissue growth and regeneration. The data Rudnicki presents has the potential to contribute to biotechnology and its emerging emphasis on stem cell and gene therapy.

Funding: Ontario Research and Development Challenge Fund $7,533,000

Université d'
University of
Ottawa

Role of Bacteria in Metal Cycling in Mining Environments

Danielle Fortin, an earth scientist, is pursuing research on the role of bacteria in metal cycling in mining environments. The generation of acid-mine drainage from abandoned sulfide-bearing mine tailings is a major environmental concern. The acidity generated from the chemical and microbial oxidation of sulfide minerals, along with the release of large concentrations of toxic heavy metals, can endanger surrounding terrestrial and aquatic ecosystems. The fate of sulfur and metals, such as Fe, Cu, Zn, Pb, Cd, etc., strongly depends on precipitation and dissolution reactions triggered by redox changes and microbial activity within the tailings. Microbial reactions occurring within the anoxic portion of mine tailings are however poorly understood, because it was long thought that heterotrophic bacteria could not be present and active in tailings because of the lack of organic substrates. It is only recently that several studies (including several ones by Fortin et al.) have indicated that sulfate-reducing bacteria (SRB) and iron-reducing bacteria (IRB) were present in the sediments of mining lakes and in mine tailings, even under oxic and acidic conditions and that they participated in Fe and S cycling. Such findings have a profound effect on the overall fate of Fe and S in mine tailings because both types of bacteria affect the solubility of Fe- and S-bearing minerals. For instance, Fe-oxides can be reduced in the presence of IRB and generate high concentrations of soluble Fe(II) in the porewater. On the other hand, the microbial reduction of sulfate to sulfide can promote the formation of iron sulfide precipitates and increase the mineral sulfide content of the tailings. It is therefore extremely important to better understand the cycling of Fe and S in order to assess the mineralogical evolution of mine tailings and predict the impact of acid-mine drainage on the surrounding ecosystems.

Ongoing research in Fortin's laboratory focuses on the ecology of SRB and IRB in several mine tailings sites in Northern Ontario. Results indicate that SRB are present under various physico-chemical conditions, but they are only active where a strong redox gradient exist within the tailings. The presence of IRB will be investigated in the summer of 2002 as part of Fortin's NSERC research project. *In situ* rates of iron and sulfate reduction will be determined and the factors regulating the activity of both IRB and SRB will be investigated in the laboratory. Stable isotope analyses will be used, along with specific molecular probes in order to assess the role of microbial processes in metal cycling. The project involves one M.Sc student (Jean-Philippe Rioux) and one post-doctoral fellow, Dr. Tanmay Praharaj.

Funding:	Premier's Research Excellence Award	$100,000
	University of Ottawa	$50,000

Université d' University of Ottawa

3-D Modeling of Neural Regeneration

Dr. Steffany Bennett
Principal Investigator
(NRL and NVU)

Patients suffering from Alzheimer's Disease increasingly retreat into their own world of memory loss, frustration, and loneliness. In the later stages of the disease, they are unable to sustain an independent existence and are dependent upon family and, ultimately, health care institutions for basic care. This is not the quality of life aging Canadians should expect. Thanks to funding from **Ontario Innovation Trust**, **Canadian Foundation for Innovation**, and a **Premier's Research Excellence Award**, research in Dr. Steffany Bennett's Neural Regeneration Laboratory (NRL) focuses on two complementary programs: one designed to reduce progressive neural loss and the other designed to regenerate damaged cerebral tissue in neurodegenerative disease. The mammalian adult brain, once thought to be completely post-mitotic, is now recognized to contain a finite number of neural stem cells; progenitor cells with the capacity for self-renewal and the ability to differentiate into functional neurons and glia. Detailed study of the regenerative potential of endogenous adult neural progenitors is complicated by the extreme rarity of the target cell (< 1% of cells in the adult human brain). A major advance would be identification of an *in vivo* genetic model in which the adult neural stem cell populations are enriched thereby providing a larger pool of cells for study. Dr. Bennett's team is working to develop such a mouse model to understand whether adult neural stem cells can be activated to counteract Alzheimer's Disease.

Tia Moffat, Sandy Beyko, and Sherri Boucher (NRL Graduate students)

With the help of **Ontario Innovation Trust** and **Canadian Foundation for Innovation**, Dr. Bennett will be able to create a Neural Visualization Unit (NVU) to visualize neural stem cell activation. The innovation inherent in the NVU is that the unit will have the capacity not only to generate high quality microscopic images but also to model in the kinetics of neural stem cell proliferation, differentiation, and death over time and in 3-dimensional space. To achieve this goal, Bennett's NRL works as a team. There is significant public concern that Canada is unable to retain highly qualified personnel and health care personnel. As a result of a **Premier's Research Excellence Award**, Dr, Bennett has been able to recruit a post-doctoral fellow, six graduate students, and two undergraduate students to her laboratory. The goal is to inspire these researchers to remain in Canada and establish their own independent careers. Access to NVU, will provide world-class opportunities for trainees who wish to gain expertise and skills in neural imaging, neural modeling, molecular biology, and neural signaling using transgenic technologies.

Funding:		
	Ontario Innovation Trust	$195,573
	Canadian Foundation for Innovation	$195,573
	Premier's Research Excellence Award	$100,000
	University of Ottawa	$50,000

Université d'
University of
Ottawa

Inhibitors of PCs and SKI-1 in Health and Disease

The CFI grant matched by **OIT** awarded to Dr. Ajoy Basak in 1999 helped to purchase a number of highly sophisticated instruments dedicated to state of the art research in protein and enzyme chemistry. These instruments included automated peptide synthesiser, amino acid analyser, protein sequencer, fluorometer, HPLC and circular dichroism. These equipments became a key infrastructure component for the newly formed Regional Protein Chemistry Centre at Ottawa Health Research Institute and also for the Centre for Catalysis Research and Innovation (CCRI) at University of Ottawa.

Impact

The creation of above centres resulted in very fruitful and productive interdisciplinary collaboration both within and outside the institute where Dr. Basak's expertise in peptide/protein chemistry and its biology played a major distinctive role. So far 5 summer students, 2 co-op students and 1 honor student have received training and some have already found better opportunities in academic and industrial institutions. Dr. Basak has also initiated industrial partnership and collaboration. One patent application on his research is pending.

Research

Dr. Basak's research is focussed on a family of cellular endoproteases that are associated with health and disease. These proteases collectively known as **Proprotein Convertases (PCs)** and their recently discovered subtype called **Subtilisin Kexin Isozyme-1 (SKI-1)** were shown to cleave at selected sites various proproteins and prohormones into their biologically and functionally active forms. Little progress has been achieved to study the clinical relevance of PCs and SKI-1 through the production of specific inhibitors, although in many areas of disease protease inhibitors are increasingly getting major attention because of their enormous potential. Dr. Basak's group has made outstanding contributions in identifying specific physiological substrates of PCs and SKI-1 and the endogenous and synthetic modulators or inhibitors of these proteases.

He has characterised individual PCs and SKI-1 responsible for proteolytic maturation of surface glycoproteins of HIV, Hong Kong virus, CMV, RSV, Lassa virus and several bacterial toxins. His efforts have resulted in the development of peptide and nonpeptide inhibitors of PCs and SKI-1 and showed *in vitro* their antiproteolytic, antibacterial, anti-proliferative and antiviral properties. These inhibitors will have profound impact as therapeutic agents especially in viral, bacterial pathogenesis as well as in neurological such as Alzheimer's and proliferative diseases such as cancer.

Research results have been promising and discussions are on-going with regard to patent and commercialization of some of his protease inhibitors.

Funding: Ontario Innovation Trust, CFI, OHRI $499,000

Université d' University of Ottawa

SAVANT Research Laboratories

The Software engineering And Visualization for Applications in the Next-generation InterneT Research Laboratories (SAVANT) are located in the new building of the School of Information Technology and Engineering (SITE) at the University of Ottawa. These research facilities will be home to the following new research laboratories:

- Distributed Collaborative Virtual Environments Research Laboratory (DISCOVER)
- Advanced Internet Applications and Systems Research Laboratory (AIAS)

The OIT and CFI funds provide the foundation for research equipment to be installed in these new laboratories, including a high-end virtual reality system, high-end servers and Unix and PC workstations, advanced networking equipment (powerful routers, switches and optical equipment), as well as systems for advanced video encoding-decoding, storage and distribution. The OIT has also awarded $7M or 40% of the construction costs for the SAVANT laboratories which are part of the SITADEL research labs funded by ORDCF.

Gregory Bochmann
Project Leader for SAVANT

Nicolas Georganas
Project Leader for DISCOVER

Research Projects

The DISCOVER Laboratory provides an infrastructure for collaborative virtual environments. Centered around a facility for Immersive Collaborative Virtual Environments (CVE) it supports research in virtual environments and related technologies as well as interdisciplinary research. It includes applications in Telecommunications, Image Processing, Industrial Tele-Training, Tele-Presence, Industrial Prototyping and Manufacturing, Mechanical Engineering, Tele-Robotics, Cardiovascular Medicine, Rehabilitation Sciences, Arts and many other areas.

Collaborative Virtual Environments (CVE) are currently one of the most challenging areas of research in Virtual Reality (VR) because it adds new dimensions to human-factors, networking, synchronization, middleware, object model acquisition and representation and other issues. For example, human-factors research in VR has traditionally focused on the development of natural interfaces for manipulating virtual objects and traversing virtual landscapes. Collaborative manipulation, on the other hand, requires the consideration of how participants should interact with each other in a shared space, in addition to how co-manipulated objects should behave. Other issues include: how participants should be represented in the collaborative environment; how to effectively transmit non-verbal cues that real-world collaborators so casually and effectively use; how to best transmit video and audio via a channel that allows both public addressing as well as private conversations to occur; how to deal with different time-delays and how to sustain a virtual environment even when all its participants have left.

The AIAS Laboratory provides an infrastructure for research in Advanced Internet Applications and Systems. During the last years, the Internet has emerged as the major network infrastructure, not only for

computer-based information exchange, but also for most person-to-person communication. It is rapidly becoming an indispensable vehicle for human interaction (messaging, telephony and video-conferencing, as well as cooperative work and tele-teaching) and business transactions (tele-banking, electronic commerce, advertising, publishing, etc.)

A standardization effort is underway for defining standard protocols for providing network services that provide an efficient and flexible basis for the development of new communication services and applications over the Internet. Most of these future telecommunication applications involve multimedia (i.e. sound and video) and require certain transmission characteristics from the network, commonly called quality of service (QoS). It is expected that in the future Internet different classes of service with different QoS will be distinguished. Successful development of technology in this area will trigger a wider penetration of services based on advanced applications in almost all main sectors of our society, such as medicine, education, business, entertainment, manufacturing, electronic commerce etc.

The AIAS laboratory will provide an environment for experimenting with these advanced telecommunications and other distributed applications. Current research projects include a project in collaboration with IBM on load balancing for Web servers in the context of e-commerce applications, projects on network management and quality of service provisioning for multimedia applications, as well as work on user mobility and quality of service negotiation at the application level, taking into account the available devices and user preferences. Some of the project also address questions of security and the authentication of mobile users.

Funding:
The budget overview for the SAVANT laboratory equipment and software infrastructure is as follows:

Total infrastructure budget	$6,269,215
Ontario Innovation Trust	$2,497,724
Canada Foundation for Innovation	$2,497,724
Industrial contributions (Silicon Graphics, Nortel Networks, SUN and CISCO)	$1,273,767

Queen's University

High Performance Computing Aids Aircraft Design

HPCVL

At a time when Canada's aircraft industry is in a tailspin, experiments in computational turbulence at Queen's University – conducted through the High Performance Computing Virtual Laboratory (HPCVL) – are expected to have a huge impact on the efficiency and design of modern aircraft and other transportation processes.

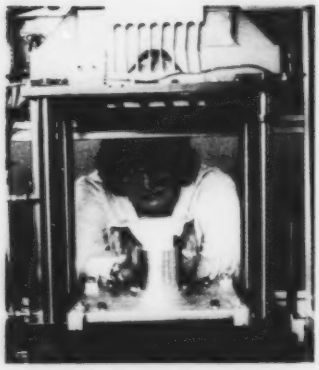
Directed by Dr. Andrew Pollard, in the Computational and Experimental Fluid Dynamics Laboratory in Queen's Department of Mechanical Engineering, these simulations will affect many areas of transport efficiency, including decreases in fuel consumption and costs, more efficient combustions, and the ability to provide greater aircraft maneuverability. "We're targeting control of turbulence and combustion within the framework of Large Eddy Simulation, and are finding details that have never been observed before," says Dr. Pollard.

Another HPCVL project, run by Queen's psychologist Dr. Douglas Mewhort, uses computational models to analyze the internal representation of perceptual memory. "With the supercomputer available through HPCVL, we're able to better our understanding of perceptual memory into a larger account of the brain's general knowledge representation," Dr Mewhort explains. "This allows us to make greater strides in the study of human performance."

Established in 1998 by Queen's University, Carleton University, University of Ottawa and the Royal Military College of Canada (RMC), HPCVL offers a world-class virtual environment for researchers, faculty and students. In 2001 HPCVL received **$7.28 million in funding from the Ontario Research and Development Challenge Fund (ORDCF).**

Queen's University

Centre for Automotive Materials and Development



A Queen's led automotive research and education facility is advancing Ontario's competitive edge in the auto parts industry.

With **$6,864,200 in funding support from the Ontario Research and Development Challenge Fund**, the Centre for Automotive Materials and Development (CAMM) brings together industry, government and leading universities to develop vehicles with superior standards of energy, safety and comfort.

Since its founding in 1998, the Centre has attracted McMaster as a partner university along with more than 20 automotive sector companies to participate in research and development projects. The project has not only enabled automotive companies to access university research to address design challenges but also helped meet the education needs of those employed in the highly specialized automotive sector. More than 30 research projects involving about 75 graduate students, research associates and postdoctoral students are now underway at the Centre. Key areas being researched include manufacturing economics, advanced automotive plastics and forming and joining automotive sheet.

CAMM has succeeded in attracting senior managers from automotive companies and their suppliers to serve on its board of directors. Other early successes include a patent application that is now being processed in the area of vibration welding of plastic composite components; the development of finite element simulation methodologies for springback after forming and assembly of automotive panels; the building of a state-of-the-art laboratory for investigating magnesium production processes, and the writing of a book, Manufacturing in Real-Time: Industrial Engineering in an Age of Intelligent Machines, currently being used as a teaching aid in a fourth-year engineering course.

Queen's UNIVERSITY

Laser Research Increases Understanding of Ozone

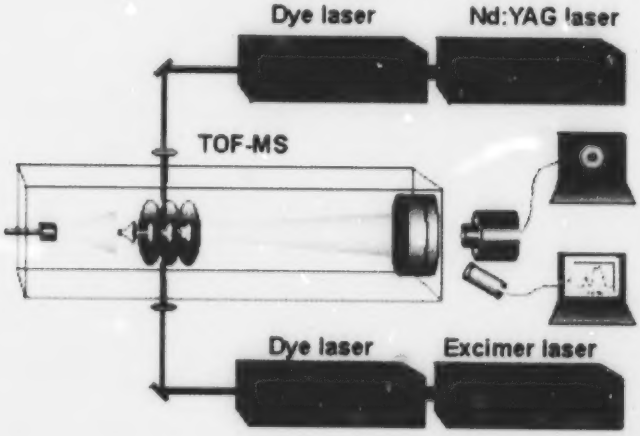
Using a photo fragment imaging apparatus that is the first of its kind in Canada, Queen's University chemist. Dr. Peter Loock and his research team are able to observe what happens when light breaks the chemical bonds in molecules – research that will lead to a better understanding of the process of ozone depletion in the atmosphere and urban smog.

The extremely fast and elusive photochemical processes were previously undetectable at this high resolution.

In experiments, sample molecules are cooled by expanding them in a supersonic jet into a vacuum one trillionth that of atmospheric pressure at a temperature of 10 degrees above absolute zero. A pulsed laser is beamed at the sample molecules, breaking one of the chemical bonds that hold the atoms together. The fragments are then ionized by photons from a second laser. With an ion detector, an image is created containing vast amounts of information about the chemical reaction.

The earth's ozone layer is damaged when sunlight interacts with chemical molecules in the atmosphere, such as CFCs and methyl bromide, a common pesticide, explains Dr. Loock, who has received **$130,000 in funding from the Ontario Innovation Trust.**

"By studying the interaction of light and small, environmentally important molecules and molecule clusters and examining the fundamental scientific principles that drive these processes, we hope to observe new phenomena that will help us deduce how more complex reactions are going to take place," says Dr. Loock.



Queen's UNIVERSITY

Education Research

Dr. Lesly Wade-Woolley of Queen's University's Faculty of Education is examining the development of reading skills in children learning English as a second language – research that will contribute to the development of curriculum and better instruction techniques for children from diverse backgrounds. It will also help identify more effective teaching methods in support of children with learning difficulties.

As globalization and immigration trends continue to profoundly shape Canadian society, issues related to the acquisition of second language literacy skills become increasingly important. It's critical, says Dr. Wade-Woolley, that we build a solid research foundation in this area and continue to enhance our understanding of the learning challenges involved.

The **PREA winner** is investigating the relationship between reading and speech processes in first and second languages of second-language children who have been assessed as poor readers. A key thrust of her research is examining how literacy processes in children and adults reading a second language are affected by the characteristics of their native language. Another key area of study involves the identification of predictors of successful reading and spelling development in children learning a second language.

Queen's UNIVERSITY

Hyperpace Helmet

A Queen's University physiologist continues to gain new insights into the controversial diagnosis of Attention Deficit Hyperactivity Disorder (ADHD). Dr. Doug Munoz, a **PREA winner**, has developed a more accurate, scientific diagnosis for ADHD that is expected to address widespread concern about over-diagnosis of the disorder in children. Significant disparities in reaction to eye-movement tests suggest some children have true neurological problems, whereas others may have a different problem.

Dr. Munoz has also now patented a portable virtual reality helmet for detecting abnormal patterns of eye movement in young children. It is hoped that school boards will use this device to help identify visual and eye movement deficits in children with ADHD who experience difficulties learning to read.

As part of his ADHD research, Dr. Munoz engages children and adults in video games in a darkened room of his eye-movement laboratory. While his subjects look at a large video screen where tiny specks of light appear and disappear, the Queen's scientist instructs them to look at, or away from the light or to look to the left or the right independent of where the point of light originates. How his subjects perform on eye-movement tests has provided critical information for assessing and measuring impulsivity and attention.

In an exciting new development in the Munoz lab, functional magnetic resonance imaging is being used to measure brain activity in awake subjects performing the eye-movement test. Through images of brain activity, researchers can see which brain areas are used when performing the test and whether these areas are altered in those with ADHD.

RYERSON
UNIVERSITY

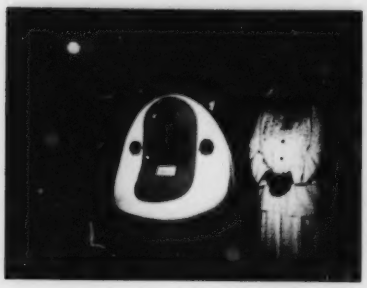
Business Geomatics

The Centre for the Study of Commercial Activity (CSCA), headed by Dr. Ken Jones, has developed a world-class research program in business geomatics. Support from a GEOIDE NCE $750,000, three-year grant and a second five-year term NSERC/SSHRC Chair in Technolological Change in Retailing of $500,000 have been fundamental in the development of the CSCA as an internationally recognized research centre in the area of spatial information technologies and the application of GIS. Over the last two years increasing interest has been shown by private and public sector organizations in developing research partnerships with the CSCA. These have included: Statistics Canada, Ontario Ministry of Economic Development, Liquor Control Board of Ontario, Municipal Provincial Assessment Corporation, Ontario Municipal Employees Retirement System, MacLean Hunter, and ESRI. These partnerships are clear examples of knowledge transfer to major Canadian organizations that is occurring as a direct result of the **ORDCF** and **OIT** supported programs.

ORDCF and **OIT** research grants have resulted in a number of direct benefits in the areas of economic competitiveness and knowledge transfer. The investment has been and will be used to increase the sophistication of Canadian firms in their evaluation of spatial data and to improve their competitive position through the application of improved decision support systems and the integration of new HQP into Canadian organizations. This is evident by the fact that six of the eight MSA graduates are now employed with Canadian-based firms/organizations (i.e., Bank of Nova Scotia, PricewaterhouseCoopers, Polk Canada, Lethbridge University, Thomson and Associates and the Ontario Ministry of Transportation) in areas that use advanced geomatic technology.

RYERSON UNIVERSITY

Advanced Distance Education Tools



Ontario sources of funding through Communications and Information Technology Ontario (CITO), the Ministry of Education (MoE) and the Ministry of Energy, Science and Technology (MEST) have been instrumental in assisting researchers at the Centre for Learning Technologies at Ryerson University in developing innovative and highly successful research. The PEBBLES project funded through MoE, and led by Professor Deborah Fels, Ryerson's School of Information and Technology Management, is a communication system that links children in the hospital to their regular classroom; it has been successfully commercialized. Telbotics Inc., the Canadian company responsible for manufacturing and distributing patented PEBBLES technology, has been awarded a large US sales contract. The research generated from this project is unique in the world resulting in 17 peer-reviewed publications, three national and international awards, and numerous high profile television, newspaper and magazine articles.

Other on going research such as "Enhanced Closed Captioning for Interactive Television" (funded through CITO and MEST), and "Advanced Network Tools for all Ontario Learners" (funded through MEST) projects have produced unique technologies to benefit Ontarians with disabilities. Researchers with the enhanced closed captioning project are exploring the use of graphical, animated and tactile enhancements to text-based closed-captions so that people who are Deaf and Hard of Hearing can gain access to music, background sounds and emotion in television and film. The results of this project have the potential to completely revolutionize closed-captioning practices. Researchers from the University of Toronto and Ryerson University collaborated in the Advanced Network Tools project to produce web-based learning tools such as an accessible real-time chat tool and a music annotation system to support young learners in science, math and music. Four peer-reviewed publications and numerous presentations have been produced from these research projects.

Provincial Funding Sources

Communications and Information Technology Ontario:	$130,000
Ontario Ministry of Education and Training:	$303,665

RYERSON
UNIVERSITY

Ultrasound Imaging for Cancer Therapy

Premier's Research Excellence Award winner, Professor Michael Kolios, Department of Math, Physics and Computer Science, has also received funding from the **Ontario Innovation Trust** (matching to the Canada Foundation for Innovation) for research involving the use of high frequency ultrasound for imaging apoptosis. This funding has enabled the acquisition of a state-of-the-art high frequency ultrasound imaging system, developed and manufactured from an Ontario start-up company Visual Sonics Incorporated, the only company in the world that makes such a device. This imaging system is the only present non-invasive technology to detect apoptosis (programmed cell death - a process important to many biological processes and that may play an important role in cancer therapy) in vivo (patent pending). These awards have not only helped to attract graduate students to work on these projects, but also to attain funding from national and international funding agencies including the Natural Sciences and Engineering Research Council of Canada and the Whitaker Foundation.

Provincial Funding Sources

Ontario Innovation Trust (CFI matching):	$ 59,142
Canada Foundation for Innovation:	$ 59,142
Ontario Ministry of Energy, Science & Technology Premier's Research Excellence Award:	$100,000

RYERSON
UNIVERSITY

New Drive Technologies

Premier's Research Excellence Award winner, Professor Bin Wu, Electrical and Computer Engineering Department, together with his research team, has developed new drive technologies to assist Canadian industry leaders. Two major benefits from this Ontario-funded collaboration include the provision of training for highly qualified personnel and assisting the Canadian electric drive industry in achieving further technical and commercial success in the global market. This has resulted in a positive impact on job creation and stimulated Canada's economic growth.

Since the establishment of a Laboratory for Electronic Drive Applications and Research (LEDAR), the four principal investigators on the research project team have accepted fourteen new graduate students, two post-doctoral fellows and two visiting professors. All research personnel are using the advanced research equipment provided by LEDAR. Most of the graduate students will complete their program in two years, and, upon their graduation, be able to find employment in Canadian industry.

LEDAR is working very closely with industry leaders Rockwell and Honeywell, in developing new drive technologies. Rockwell has asked Ryerson to develop a super high power (10MVA to 30MVA) motor drive to satisfy the market needs. For Honeywell a prototype unit has been developed for a 20hp Next Generation Motor Controller for aerospace applications. In addition, Honeywell has expressed their interest in working with Ryerson to develop 100hp synchronous motor drive technology. Boeing has shown a strong interest in this technology and has requested a demo unit to be delivered for field-testing.

Provincial Funding Sources

Ontario Innovation Trust (CFI matching):	$395,978
Canada Foundation for Innovation:	$395,978
Ontario Ministry of Energy, Science & Technology Premier's Research Excellence Award:	$100,000

UNIVERSITY OF TORONTO **Centre for Innovation Law and Policy**

E-commerce, biotechnology, intellectual property, privacy, venture capitalism – these are buzzwords of the new economy. For scholars at U of T's Centre for Innovation Law and Policy, they are also central topics in innovative research that bring the academy and the business and legal communities together in new ways. The Centre is devoted to the study of laws, institutions, and policies that affect, or are affected by, innovation or technological change.

A flourishing community

The Centre's pioneering work has been made possible by an award of over $12-million from the **Ontario Research and Development Challenge Fund**. By recognizing the visionary potential of a proposal from Ron Daniels, Dean of the Faculty of Law, **ORDCF** helped to create a new centre of excellence that is already making waves in both the academic and business sectors. The Centre is a community with a flourishing esprit de corps, promoting a continuous exchange of ideas between faculty, students, visiting scholars, and the world outside academe.

Lisa Austin

Hudson Janisch

Dean Ronald F. Daniels

Richard Owens
Centre Director

Endowed chairs have attracted star scholars from Canada and abroad, such as Hudson Janisch, Canada's leading specialist in telecommunications law, and Jonathan Putnam, who left a consulting position in Boston to teach intellectual property law at the Centre. Lisa Austin, an expert in information privacy and intellectual property, has begun her academic career as a new Assistant Professor affiliated with the Centre. **ORDCF** funding has thus enabled the Faculty of Law to achieve a rare feat: attracting first-class innovation law specialists to academia despite the promise of lucrative private-sector employment. These researchers and their graduate students are already recognized as among the best in their field worldwide.

Beyond the ivory tower

This work helps to meet the growing demand of the business and technological communities for information and policy advice on e-commerce, intellectual property, and many other legal issues. Graduates of all six Ontario law schools will now be better equipped to provide this expertise, giving Ontario a major competitive advantage nationally and internationally. The Centre is working together with both the Intellectual Property Institute of Canada and the University of Toronto's School of Continuing Studies to provide course offerings and certificate programs to those already in the work force. In all of these ways, **ORDCF** funding has helped to make the legal "ivory tower" open and accessible to the larger world.

UNIVERSITY OF TORONTO **Centre for Advanced Coating Technologies**

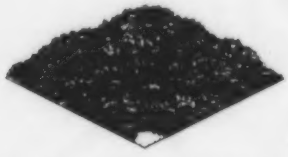
On visiting the website for the Centre for Advanced Coating Technologies (http://www.mie.utoronto.ca/labs/tsl/), the surfer is immediately struck by two animations, both of flat surfaces being covered by glutinous liquids. The first resembles a cake being squirted with decorative icing, while the second looks more like pancake batter hitting the surface of a griddle in overlapping splats. We're not looking at a step-by-step guide to baking, but observing a technology that may soon become commonplace in the telecommunications, aerospace, and agriculture industries, to name a few.

Awards from the **Ontario Research and Development Challenge Fund** and the **Ontario Innovation Trust** in 1998 allowed Javad Mostaghimi to found the CACT, which focuses on thermal-spray coating technologies. Researchers inject metallic or ceramic powders into a jet stream of high-temperature, high-velocity gas. As the powder particles melt, they are hurled towards a solid surface, where they rapidly solidify into a highly durable protective coating. These coatings are both more effective and more environmentally friendly than older technologies; for example, the practice of chrome plating has recently been outlawed in the United States, and Mostaghimi's technique has been identified as the most suitable replacement for this practice. The spinoff company Simulent Inc. was formed to bring these innovations to the private sector, and firms such as General Electric and Pratt & Whitney have also taken advantage of the new coatings. Lightweight automotive brakes will be part of the CACT's next frontier. Rarely does a research initiative combine fundamental scholarly breakthroughs and practical application with such convincing speed.

Thanks in large part to the provincial government's support; the University of Toronto will be able to keep Prof. Mostaghimi here in Canada, averting a major loss to the University and the province. An Ontario Distinguished Researcher Award will solidify the position further. The funding has also allowed the University to successfully retain Mostaghimi's colleagues Sanjeev Chandra and Tom Coyle. The Centre has also attracted two outstanding new recruits: Nasser Ashgriz, a senior researcher, and Markus Bussmann, a U of T grad who will leave a position at Los Alamos National Laboratory in Mexico to return to Toronto.

So the next time you buy a new car or take a flight across the country, think of Javad Mostaghimi and his team -- and of the **ORDCF** and **OIT** programs, which helped to make their research goals a reality.

Javad Mostaghimi



A coating developed at CACT (artist's impression)

UNIVERSITY OF TORONTO **Chemical Engineering and Applied Chemistry**
Chemistry, Faculty of Arts & Science

In late August of 2001, media worldwide focused attention on astonishing news emerging from the American Chemical Society's annual meeting in Chicago. Lab rats with paralyzed spinal cords had received plastic tubular implants, causing the damaged nerve cells in their spines to regenerate. After eight weeks, the rats had regained partial use of their hind legs. Though the principal investigator was careful to state that no magic answers had yet been found, the story awakened hope that thousands of patients with spinal-cord injuries and other neurodegenerative diseases could find an end to their suffering.

The ACS meeting spotlighted something that University of Toronto scientists had known about for years: the brilliant research of Molly Shoichet and her team at the Institute of Biomaterials and Biomedical Engineering. Shoichet is one of a number of outstanding scholars working in the burgeoning field of tissue engineering at U of T; her colleague and collaborator, Christopher Yip, is another (see PREA profiles at the end of this document).

Like many young researchers working in Canada, Shoichet has been wooed by other institutions, including some in the United States. She also has extensive private-sector experience, and could well have been seconded by a high-paying job in the biotechnology industry. In 1999, Shoichet received a Premier's Research Excellence Award, which has helped her to build an internationally competitive research group based in Canada. A series of Ontario Distinguished Researcher Awards, from the **Ontario Innovation Trust**, have enabled the creation of the Centre for Cellular and Biomolecular Research, allowing Shoichet and her tissue engineering colleagues Yip, Dennis Cvitkovitch, and Peter Zandstra to collaborate with over 60 other researchers in medicine, pharmacy, chemistry, computer science, and many other disciplines.

This Centre has been crucial in retaining distinguished young scholars like Shoichet, attracting exciting new recruits, and bringing bioengineering to a new plane of excellence at U of T. Without the **OIT** and PREA programs, the University would certainly have lost these opportunities for innovation, collaboration, and excellence on an international level.

Molly Shoichet

UNIVERSITY OF TORONTO **University of Toronto at Mississauga**

The biotechnology revolution is underway, and one of its hotspots is the University of Toronto at Mississauga, where an unprecedented synergy of researchers, students, and equipment is producing exciting, leading-edge results. The overwhelming momentum that now exists at UTM is due to two major awards: the first from the **Ontario Research and Development Challenge Fund**, and the second from the **Ontario Innovation Trust**, working with the Canada Foundation for Innovation, this past May (2001). Thanks to these awards, the Centre for Applied Biosciences and Biotechnology (CABB) is now in operation.

Laying the foundations

Ulrich Krull

Only a few years ago, the physical sciences at UTM were mainly undergraduate teaching programs. But the revolution began with the **ORDCF's** funding of the Centre for Drug Discovery in 1999. This award resulted in the appointment of Prof. Ulrich Krull as the AstraZeneca Chair in Biotechnology and the hiring of three additional faculty, one a senior genetics researcher. In consultation with the pharmaceutical industry, the scientists designed the new Master of Biotechnology program, designed to meet the growing personnel requirements of industry in this burgeoning field. The program, the only one of its kind in Canada, was launched in May, 2001.

OIT contribution: making UTM Biotech internationally competitive

With these pieces in place, Prof. Krull and his colleagues applied to **OIT** and CFI to obtain funding for new state-of-the-art equipment and facilities. The result is the CABB, which makes possible the fundamental genetic research that is at the heart of the field. The Centre gives UTM the power to attract scholars of an unprecedented calibre. Marla Sokolowski, a pioneer in behavioural genetics, holds a Canada Research Chair and an Ontario Distinguished Researcher Award, and is one of the youngest scholars ever named a Fellow of the Royal Society of Canada. The presence of Michael Georges, a new UTM recruit, makes possible an exciting interface between physical and biological chemistry that would be impossible without the **OIT**-funded infrastructure. Another exciting project, led by James Anderson and Leah Cowen, involves fungi that cause antibiotic-resistant infections. The equipment will allow Anderson and Cowen to work toward altering the genetic behaviour of the fungi, thus conquering the resulting infections. Prof. Krull himself might have left for greener pastures if the CABB had not come to fruition, but his research in molecular discovery will now call UTM home for the foreseeable future. For the first time in over a decade, says Prof. Krull, Chemistry at UTM can compete with the best in the world.

UNIVERSITY OF TORONTO

PREA Recipients

Robert Batey - Dept. of Chemistry

An outstanding young organic chemist, Rob Batey was a PREA winner in 2000. He is a pioneer in the field of drug discovery, exploring chemical reactions that can be applied to the synthesis of new drugs for a wide range of diseases. Provincial funding has been key to creating the research environment necessary to support this exciting work. Batey's lab has also produced many graduates who have been recruited into academia and the pharmaceutical industry.

Timothy Hughes - Dept. of Medical Genetics and Microbiology

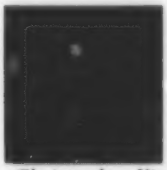
This year, American geneticist Timothy Hughes was a PREA winner, an honour that clearly shows the commitment of the province and the University to supporting his innovative research. Hughes studies the functions of genes and proteins that have never before been investigated in the laboratory. The research uses DNA microarrays, a technology allowing scientists to examine thousands of molecules simultaneously. In large part because of the existence of provincial programs such as PREA, the University has succeeded in attracting a top-notch young scholar who might never have considered working north of the border.

Maydianne Andrade

Robert Batey

Timothy Hughes

Kelly MacDonald



Christopher Yip

Maydianne Andrade - Dept. of Zoology, University of Toronto at Scarborough

A PREA winner in 2001, Andrade is studying the mating patterns of cannibalistic black widow spiders. Male spiders of some species are sacrificed during copulation. This research will lead to an enhanced understanding of mating theories and sexual selection, challenging conventional ideas of male behaviour. Provincial funding has helped the University of Toronto at Scarborough to create an attractive working climate for Andrade, who has been recruited back to Canada after doctoral studies at Cornell University.

Kelly MacDonald - Director, HIV Research Program, Mount Sinai Hospital

MacDonald, a 2001 PREA winner, is developing a vaccine for HIV, an unprecedented step toward better prevention and treatment of this global epidemic. MacDonald's hiring in 1994 began a process of recruitment and fundraising that has resulted in a world-class HIV/AIDS research centre at Mount Sinai Hospital, an affiliate of the University. PREA support will further MacDonald's research into HIV in sub-Saharan Africa, particularly Kenya, where she spends three months each year.

Christopher Yip - Dept. of Chemical Engineering

Chemical engineering professor Chris Yip is one of the University's rising stars. Provincial government research funding programs, including a PREA in 1999, have played a prominent role in creating a research environment that has kept this outstanding scientist in Canada. Yip examines biological processes at the molecular level. His group investigates the ways atoms and molecules interact with one another in real time. They hope to be able to block or enhance these interactions, thus opening the door to a wide range of technologies.

TRENT UNIVERSITY

Research Success Stories

Research linking emotion and health

Psychology Professor James Parker is conducting innovative research supported by the PREA focusing on two studies that extend current knowledge about emotional intelligence and mental and physical health.

"Emotional intelligence refers to the ability to accurately express and regulate emotions," says Parker.

The first study examines the development of emotional intelligence in children and adolescents, as well as the relationship between emotional intelligence and the development of various psychological problems (like depression). The second study examines the relationship between emotional intelligence and the presence of unexplained medical symptoms (chronic pain) in adults. All of the PREA funds are being used to support various graduate and undergraduate students who are working on these studies.

Uncovering the mercury puzzle

There's no doubt that mercury levels in lakes throughout North America have reached alarming levels; for years, various species of fish have been "blacklisted," and public warnings about the dangers of mercury toxicity have become commonplace. But while coal-burning power plants have been identified as major contributors to the problem, there are many steps in the process that are not yet well understood. That's why Dr. Holger Hintelmann decided to devote his current research to uncovering the exact conditions that lead to high levels of mercury, and making recommendations to industries as to how they can most effectively remedy the situation.

As Hintelmann points out, while mercury contamination is certainly widespread in lakes across Canada, it is also a global issue. In South America, for example, gold mining is a major source of mercury contamination. Virtually anywhere there is fossil fuel burning, in fact, mercury is a concern. For this reason, 10 different research institutions throughout the United States and Canada are collaborating on a five-year project, which began in 1999. The metaalicus project (Mercury Experiment to Assess Atmospheric Loadings In Canada and the United States) will answer for the first time what happens to fish mercury concentrations when there is a change in atmospheric mercury deposition. At Trent, undergraduates as well as graduate students are taking on active roles with fieldwork, and Hintelmann notes that the scope of this research extends into a variety of other areas as well. First Nation communities, for example, are keeping a close eye on this and other studies affecting the environment, and it also has obvious relevance to those interested in native issues, both at Trent and elsewhere. Even the research itself involves a variety of different disciplines, including chemistry, geology, and biology. This, Hintelmann adds, is a bonus for students working on the project, as they gain experience and knowledge in a number of different fields. Its international profile will no doubt add to the broadening of students' horizons as well, now and in the years to come.

University of Waterloo

The New Bell University Laboratories

The **Ontario Research and Development Challenge Fund** has provided pivotal support for the Bell University Labs (BUL) at the University of Waterloo, which is also funded by Bell Canada, **Canada Foundation for Innovation**, **Ontario Innovation Trust** and the University. BUL conducts leading edge research in computing, networking and communications with strong ties to Bell Canada, in a co-determined program of research projects. BUL's projects are designed for interaction between the University and Bell Canada about problems, ideas and research results, culminating in the training of an internationally competitive workforce in these topic areas, and in the transfer of talent and results to Bell Canada. There is a Bell University Lab at the University of Toronto and in Montreal, and a few inter-university research projects are underway.

Through BUL, the research capacity at UW has been increased in two areas of strategic importance: wireless networks and data management. In wireless networks, projects currently in progress include network traffic modeling, voice over mobile IP, mobility and adaptation, and customizable portals. Projects in the area of data management include managing distributed data resources, managing XML data resources, Internet access to map data, and data mining. Other projects in the BUL program investigate aspects of Internet applications, computational finance, human computer interface, data compression, speaker identification and verification, computer vision, organizational effectiveness, and cardiac rehabilitation. A total of 35 faculty members and over 60 graduate students have participated or are currently participating in research projects.

Eugene Roman commented, "Bell University Labs provide a unique opportunity for collaboration between researchers and Bell business units. While researchers gain access to real marketplace data and issues, Bell gains access to new ideas, expert research resources and new talent. This investment in innovation positions Bell for growth now and in the future".

Program: Ontario Research and Development Challenge Fund, Canada Foundation for Innovation, Ontario Innovation Trust with Bell Canada

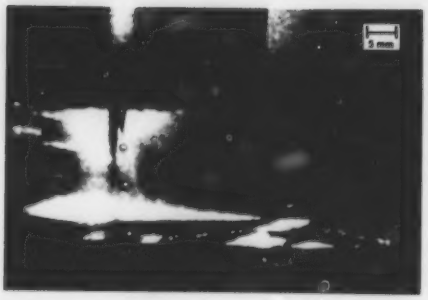
Value: $7.7 million ORDCF, $1.4 million OIT (Part of the $27.2 million Bell University Laboratories program at the University of Waterloo) $27 million

Researchers: Alan George, Computer Science, John Mark, Electrical and Computer Engineering, Frank Tompa, Computer Science, Johnny Wong, Computer Science, and over 30 other faculty members

Eugene Roman (right), Bell Canada's Chief Information Officer, uses the cell phone client software created by Prof. Kostas Kontogiannis (left) in his BUL project at Waterloo. Kostas is working with BUL researchers at the University of Toronto's School of Medicine to enable wireless devices such as Palms and cell phones to access medical information more easily.

University of Waterloo

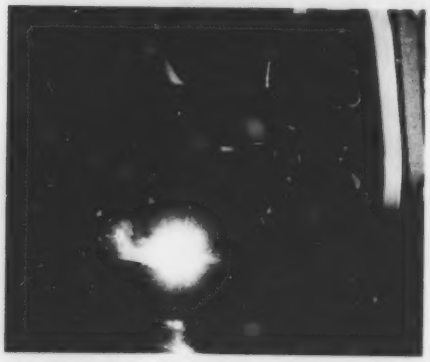
High Speed Automated Welding



The sizzle of a high-temperature, vision-searing arc held in an individual welder's hands has been largely replaced by high-speed automated welding, carried out by robotic devices. But the shift to automated welding has introduced new difficulties along with its benefits. The High Speed Automated Welding Project, based in the University of Waterloo department of Mechanical Engineering, is seeking to remove those difficulties and increase productivity and reliability.

In this particular **Ontario Research and Development Challenge Fund** project, Professors Hugh Kerr, Dave Weckman, and Jan Huissoon, Mechanical Engineering, are examining the Gas Metal Arc (GMA) welding process, in order to identify strategies that will allow faster welding without creating defects such as undercutting and humping that are characteristic of high-speed automated welding.

To examine the process and the defects that occur, it is first important to have a better understanding of the process. A new model has been developed. Comparison of the model with experiment requires that the actual arc length and electrical conditions be measured for various welding conditions. The arc length can be observed using a special camera system, a Laser Strobe. It employs a laser for illumination, and then filters out the arc light to give an image of welding process without the bright light from the welding arc. An example is shown in Fig. 1. Observations of how the weld pool changes shape can then be used to clarify how defects occur under different welding conditions. Real-time examination of the weld geometry using a simpler vision system is also being developed, to provide feedback to a control system.



Another aspect of the project is to examine the "tandem" arc process, which employs two arcs simultaneously. A photo showing the robot and tandem process is shown in Fig. 2. The use of two arcs leads to possible complications such as arc interactions. By examining the behaviour of the arcs and weld pool for various welding conditions, we are working on a strategy to improve productivity.

Program: The Ontario Research and Development Challenge Fund; various industrial partners

Value: $ 1.7 million

Researchers: Hugh Kerr, Dave Weckman, Jan Huissoon, Mechanical Engineering

University of Waterloo

Centre for Applied Cryptographic Research

Everything that has ever been invented that has contributed to the progress of mankind, from electricity to computer chips, has been as the result of basic research in mathematics and physics. The University of Waterloo is already renowned for strength in those critical sciences. The university established a Centre for Applied Cryptographic Research (CACR) in 1998 and now is developing a world-class institute for quantum computing and quantum cryptography. In large part, a grant from the **Ontario Research and Development Challenge Fund** has enabled the CACR to flourish by taking steps to expand its capacity and comes at a time when Waterloo, Ontario is becoming a world focus for research activity in cryptography and quantum computing.

The CACR is inter-disciplinary, bringing together the top research scholars at UW in Electrical and Computer Engineering, Computer Science, and Pure Mathematics, in addition to experts in the Department of Combinatorics and Optimization. UW's researchers are able to bring experience and competitive drive to this field that is attracting a great deal of research attention around the globe.

The research interests and activities of the CACR include numerous disciplines and individuals at the University, in government, and in the broader North American economy. Sponsors of the Centre, present and past, include the University of Waterloo, NSERC, **ORDCF**, Pitney-Bowes, Certicom, Alcatel Canada Inc., the Communications Security Establishment, Mastercard, Mondex International, MITACS, Jetnet, Tivoli, the Fields Institute, the Information and Privacy Commission of Ontario, CITO, and Orange & Associates. In response to interest from these sponsors and various CACR members, the CACR has organized and hosted 16 workshops and conferences.

Douglas Stinson, Combinatorics & Optimization Research
Professor, NSERC/Certicom Corp. Research Chair in Cryptography
BMath (Waterloo), MSc (Ohio), PhD (Waterloo)
Research
Cryptography, Combinatorics, coding theory, authentication codes, secret sharing schemes, universal hashing, resilient functions, broadcast encryption, key distribution protocols, combinatorial design theory

Scott Vanstone, Combinatorics & Optimization Research
Professor, NSERC/Pitney Bowes Research Chair in Cryptography, FRSC
BMath, MMath, PhD (Waterloo)
Research
Public-key cryptography, elliptic curve cryptography, discrete logarithm problem, finite fields, combinatorial design theory

Program: The Ontario Research and Development Challenge Fund; various industrial partners

Value: $3.3 million

University of Waterloo

Live Fire Research Facility

Fire is unpredictable at best — deadly at worst. Burning structures in a controlled environment gives experts the opportunity to study fire behaviour, and make valuable contributions to the field of fire safety. This is the kind of research that saves lives.

Beth Weckman and Al Strong (left photo) together with UW researchers from Mechanical Engineering and Applied Health Sciences, in partnership with fire services across Canada, have conducted fire training and research exercises for over a decade. This partnership has led to significant technology transfer to the fire service profession and has highlighted the need for facilities in which controlled, realistic, large-scale, live-fire research can be conducted. Building on longstanding collaborations, the Regional Municipality of Waterloo and area municipal fire departments, together with the University of Waterloo, initiated the development of a combined Fire Training and Research Complex.

A key element of the Complex is the Live Fire Research Facility. Funded through a partnership between the Region and **Canada Foundation for Innovation**, **Ontario Innovation Trust** and several industrial equipment suppliers, it houses:

- A fully equipped large-scale structural fire research building with capability for generation and control of ambient wind and ventilation conditions
- Instrumentation for scenario monitoring, control and data acquisition
- Small- and medium-scale fire research and analysis equipment
- Laboratory facilities to study the physiological impacts of fire fighting

The new facility allows fire fighters and researchers to combine forces in investigating and modeling fire behaviour, detection systems, fire suppression and fire fighting strategies by repeatedly recreating environmental conditions typical to structural fires. Results facilitate advancements in fundamental fire research on a small and large scale, with direct application to fire service and fire safety issues, performance-based building codes and occupational health in the fire service.

The Region of Waterloo's Fire Training and Research Complex with its live-fire research capability is unique in the world — truly an investment that places the University of Waterloo and Ontario at the forefront of research in Fire Safety Engineering Science.

Program: Canada Foundation for Innovation, Ontario Innovation Trust, regional, municipal, industrial partners
Value: $ 5.7 million
Researchers: Beth Weckman, Al Strong

University of Waterloo

Research in Miniature: WATLabs

Two multi-million dollar, state-of-the-art materials characterization laboratories are helping UW researchers find new and better answers to some of the questions they have been asking. The WATLabs feature two pieces of equipment that allow researchers to study phenomena and chemistry on a nanoscale: a scanning electron microscope (SEM) that provides "ultrahigh" magnification and an ESCaLab 250 Microprobe — a multi-technique imaging XPS microprobe system, capable of three-dimensional composition and high resolution chemical-state surface analysis.

The SEM can achieve a level of magnification unsurpassed anywhere in the world (up to 3,000,000 times) and it is wholly digital. Because it provides a very fine electron beam (less than 10 nanometers in diameter) it can be used as a "writing" tool to develop nanocircuits — to take advantage of many novel quantum effects. This electron-beam lithography technique is one of the future upgrades WATLabs director Tong Leung hopes to make because it has proven to be an important fabrication tool for nanotechnology.

This tool is crucial for designing smaller and smaller devices — so small that one day it may be possible for medical professionals to inject nanorobots into a patient so they may deliver oxygen, or monitor what is happening in vital organs. These nanodevices could tell physicians how well or how poorly a gland, or the circulatory or digestive systems are functioning.

Chemistry professor Linda Nazar is using WATLabs to study energy storage systems that promise to be superior to anything on the market today in terms of power output, speed of recharge, and battery life. Anyone who uses rechargeable batteries for portable electronic gadgets (cell phones, laptop computers, video cameras, CD players) will be interested in such potential improvements.

Other possibilities for the WATLabs' equipment include examining industrial problems, says Leung. A possible study, he suggests, might be to look into the premature peeling of paint from car bodies. One industrial researcher is using the tools to track soil contamination by heavy elements, while others are using WATLabs to investigate the causes of corrosion in metal parts in manufacturing.

The total cost of both instruments is over $3 million. WATLabs was among one of the very first **Canada Foundation for Innovation/Ontario Innovation Trust** facilities to come online.

Program: Canada Foundation for Innovation, Ontario Innovation Trust and industrial partnerships

Value: $3.3 million

Researchers: Tong Leung, Chemistry

Western

New Centre for Industrial Recycling

Civil and Environmental Engineering professor and **Premier's** Research Excellence Award winner Moncef Nehdi recently received $386,000 in federal, provincial and private funding to establish a Centre for Recycling Industrial and Mining Waste in Construction Materials.

Supported by the Canada Foundation for Innovation and the **Ontario Innovation Trust**, Nehdi will lead research to develop new technology for stabilizing various wastes such as polymer residues and paint wastes, incinerator ash, glass products, water treatment sludge, pulp and paper sludge, cement kiln dust, tire rubber, fly ash and bottom ash, slag, and mine tailings–in a non-hazardous, readily disposable form. Nehdi's research will also focus on designing civil infrastructure that can use such waste materials to its benefit.

"Canada is the world's largest producer of garbage on a per capita basis, and Ontario is the country's industrial heart in which many companies are suffering from waste disposal problems," says Nehdi.

"The practice of disposing of waste in landfills is no longer acceptable not only because available disposal sites are depleting rapidly and their costs are sharply increasing, but also because their future liabilities are uncertain. Working closely with industry, this new centre will draw on the Faculty's existing strengths to create international leading-edge research that will have a positive impact on our economy, quality of life, health and the environment."

Western

Protein Research at Western

Understanding the molecular basis of diseases such as cancer, multiple sclerosis and diabetes will be the focus of researchers working in the Dr. Don Rix Protein Identification Facility at The University of Western Ontario. Contributions from Dr. Rix, the Plunkett Foundation and the R. Howard Webster Foundation, as well as funding from the **Ontario Research and Development Challenge Fund**, are supporting the facility.

The Dr. Don Rix Protein Identification Facility will lead a collaborative Ontario-wide effort, involving satellite sites at McMaster University, the Hospital for Sick Children, York University, and the University of Toronto.

Proteomics, the study to systematically identify and understand the functions of proteins in cells or tissues, grows out of recent work in mapping the human genome. It allows researchers to discover the precise role of proteins in the development of diseases and may lead to their prevention, treatment and eventual cure.

"Now that researchers have decoded the human gene, proteomics is the next frontier of medical science," says Dr. Gilles LaJoie, project leader for the new facility and a professor in Western's Department of Biochemistry. "DNA is the blueprint, but it's not really the acting component in the cell. To understand cellular function and disease, you need to know more about the proteins themselves."

Dr. Rix–who graduated from Western's medical school in 1957–along with his wife Eleanor and daughter Laurie, donated $1 million towards the facility. "I can't think of anything more important than proteins to the future of health research," says Rix, who was first exposed to medicine while working in his father's pharmacy in London, Ontario.

Rix is Chairman and part owner of MDS Metro, which has interest in more than 100 private medical laboratories in Western Canada. He is also the owner of Cantest, the largest environmental laboratory in British Columbia. Recently, he received a lifetime leadership and achievement award from the B.C. Biotechnology Alliance for his contributions to the biotech sector.

Western

System Aids Earthquake and Mineral Research

Earthquake monitoring became easier this summer. A 3.8 metre satellite communications dish was installed on the roof of the Biological and Geological Sciences building at Western. This antenna will be used to communicate with instruments deployed across Canada for POLARIS (Portable Observatories for Lithospheric Analysis and Research Investigating Seismicity), a $10M Canada Foundation for Innovation and **Ontario Innovation Trust** funded project involving Western, Carleton University, the University of British Columbia, the University of Manitoba, Queen's University, the University of Alberta and Natural Resources Canada.

The POLARIS project will involve the installation of 90 earthquake monitoring stations in B.C., the Northwest Territories and Ontario. Each station will make use of various types of equipment, such as seismographs to study ground shaking, the earth's electromagnetic field and GPS monuments to investigate the slow, subtle, ongoing deformation of the continent. Data from this equipment will be beamed to Western in real time via satellite, where it will be available using the Internet to scientists across Canada.

In Ontario, scientists will study smaller quakes to see where they are occurring, where faults are and where a moderate quake could potentially cause extensive damage.

The imaging techniques will also help pinpoint targets in the search for diamonds. Researchers in the Northwest Territories will measure the thickness of the earth's lithosphere. Diamonds are typically found where the crust is especially thick.

The POLARIS project has also been complemented with a recently approved, $6.6 M **Ontario Research and Development Challenge Fund** project entitled "Ontario Research Centres in Earthquake Hazards and Continental Dynamics." The **ORDCF** project will provide funding to University of Western Ontario, Queen's University and Carleton University and involves substantial support from Ontario Power Generation and GEOIDE.

The **ORDCF** project will establish and provide operating funds for a world-class geophysical research network which will elucidate the structure, composition and physical state that drive seismic hazards and create economic mineral resources in Ontario. Funds from this project will attract and retain top geophysics talent in the province who will fully utilize the POLARIS infrastructure.

Western

SHARCNET Computer Consortium

SHARCNET is a $43M partnership between five universities (Western, Guelph, McMaster, Windsor, and Laurier), two colleges (Fanshawe and Sheridan), Compaq Canada, Bell Canada, Platform Computing, QSW, and Nortel Networks to create a world-class centre for computational research in science, engineering and business. The initial $17.9 million Canada Foundation for Innovation and **Ontario Innovation Trust** project provided an enormous incentive to the academic partners to form a broader collaboration with industry to provide the basis for a successful $25.4M **Ontario Research and Development Challenge Fund** application. Together, both grants will result in cutting edge scientific achievement, training and employment opportunities for the highly skilled researchers and technicians valued by industry, and substantial and valuable results which can be applied in the private sector.

SHARCNET is designed to meet the computational needs of the researchers over a broad and interrelated spectrum of interests such as materials science, biocomputation, and finance. By exploiting world-class supercomputing power, SHARCNET researchers–in partnership with Compaq and many other industrial collaborators–are accelerating the production of research results, and for the first time, are meeting the needs of commercial partners on a time scale appropriate for competitive business activity.

SHARCNET™

Wilfrid Laurier University

New Transition Metal Systems

A **Premier's Research Excellence Award** (PREA) for $100,000 and an **Ontario Innovation Trust** (OIT) award worth $116,440 mean a great deal to Dr. Dmitri Goussev. The chemistry professor says that funding provided by the province, often with matching funds from Laurier and other sources, allows him to advance his research into metal that can benefit the petroleum industry and help protect the environment.

Such awards "help enormously," explained Dr. Goussev when his PREA was announced days before his 40th birthday, because it permits him to hire a postdoctoral fellow to conduct research under his direction. "This is all about time. My time when I can go to the lab and do chemistry. Teaching five days a week, plus time with my students, takes a significant amount of my time. So my productivity on experimental chemical research is 40-50 percent of my time. This will now be increased two times, maybe even three times. It will be an extension of my hands.

Dr. Goussev's research involves the metals ruthenium and osmium. "The purpose of this research is to obtain new transition metal systems possessing a number of fundamentally and practically significant properties which may help to improve the efficiency of the petrochemical industry and have a beneficial environmental impact. This research will develop the co-ordination chemistry of pincer ligands with ruthenium and osmium and can lead to active new catalysts for selective and efficient processes for transformation of hydrocarbons into useful olefins and their secondary products."

His research has earned Dr. Goussev funding from a number of sources. Along with his PREA and OIT grants, he has received support from the University, the Natural Sciences and Engineering Research Council of Canada, the Canada Foundation for Innovation, Petro Canada and the Cottrell College Science Award in the United States.

Dr. Goussev received a master's degree and doctorate from the Moscow Institute of Fine Chemical Technology. He held positions as a researcher at the institution, the Institute of Organo-Element Compounds in Moscow, the University of Zurich, Indiana University, and the University of Toronto, before coming to Laurier in 1998.

Wilfrid Laurier University

Combating Nausea from Chemo

The development of chemotherapy treatment has prolonged the lives of many cancer patients. But significant side effects of nausea and vomiting often interfere with successful completion. Chemotherapy patients report not only acute nausea and vomiting during treatment, but also anticipatory nausea and vomiting upon re-exposure to the cues associated with the treatment. The more intense the initial acute nausea, the worse is the anticipatory nausea.

Anticipatory nausea and vomiting (ANV) is best understood as a classically conditioned response; that is, cues present at the time of exposure to the toxin acquire aversive properties as the result of the pairings. Anti-vomiting treatments, such as the drug ondansetron, which effectively attenuate unconditioned nausea and vomiting produced by the treatment, do not reduce conditioned nausea when administered prior to a chemotherapy session. Little is understood about pharmacological treatment of ANV.

Just over $118,000 in provincial funding – $72,000 from the **Ontario Research and Development Challenge Fund** and $46,224 from the **Ontario Innovation Trust** – supports Dr. Linda Parker's efforts to help cancer patients. Funding from this source and others has allowed her to establish the only colony of *Suncus murinus* in Canada.

Animal models of vomiting have been critical to the development of pharmacological treatments to reduce nausea and vomiting in human patients. Although rats and mice are not capable of vomiting, considerable research with dogs, cats and ferrets has resulted in the development of highly effective anti-vomiting treatments. Research with animals capable of vomiting is limited by the cost of housing relatively large animals, which reduces the number of animals that may be included in a study. But an animal model of emesis (vomiting) has been developed with the mouse-sized *Suncus murinus* (musk shrew). The animal retches and vomits when administered most emetic treatments.

Testimony of numerous patients indicates that marijuana reduces both acute and anticipatory nausea and vomiting associated with chemotherapy, thereby maintaining the resolve to continue with therapy. The results of early clinical trials indicate that pure delta-9-tetrahyrocannabinol (THC) and the synthetic cannabinoid, naboline (an analogue of THC), reduces unconditioned nausea and vomiting induced by chemotherapy treatments. But THC's ability to interfere with ANV has not been specifically evaluated. Since establishing the *Suncus murinus* colony, Dr. Parker received funding from the Canadian Institute of Health Research to evaluate the potential of cannabinoid (CB) agents to interfere with vomiting and retching produced by toxins, and to interfere with conditioned vomiting and/or retching as an animal model of ANV.

Wilfrid Laurier University

Mapping the Human Brain

A **Premier's Research Excellence Award** (PREA) for $100,000 and an **Ontario Innovation Trust** (OIT) award worth $72,283 help Dr. Philip Servos unravel the workings of the brain. His ground-breaking research into the cortical maps of the human arm and face has already uncovered a flaw in the 'map' of the brain that surgeons use when learning how parts of the brain correspond to parts of the body.

Dr. Servos, who also holds a Canada Research Chair in Cognitive Neuroscience, uses functional magnetic resonance imaging (fMRI)—a tool he has used extensively in his postdoctoral work at Harvard and Stanford—to explore the functional organization of the somatosensory cortex. "Despite significant advances in neurological research, a number of mysteries remain concerning how information coming from various parts of the body is organized within the brain," he explains.

Dr. Servos' goal is to understand the representation of the touch system, which requires determination of the size, shape and distribution of somatopic 'maps' in the somatosensory cortex, as well as the functional characteristics of these maps. Much of Dr. Servos' recent work has focused on the former challenge. Over the next two years, he will extend his research to focus on how temporal aspects of stimulation and multi-modal stimuli modulate activity in the somatosensory cortex.

"One major undertaking will be the examination of the neural substrates of the so-called 'cutaneous rabbit' effect, an illusory phenomenon in which the human touch system is fooled into sensing tactile stimulation on the body surface when, in fact, there is no physical stimulation present. Other work will concentrate on how the integration of information from different sensory modalities, such as tactile stimulation and visual detection, can enhance the detection and/or identification of stimuli."

Wilfrid Laurier University

Spatial Analysis Lab

The Spatial Data Acquisition and Analysis Laboratory at Wilfrid Laurier University stands as a model of collaboration. The $91,351 provided by the **Ontario Innovation Trust** allowed the lab to open in the summer of 2000. The original investigators – Drs. Mike English, Barry Boots, Scott Slocombe and Ken Hewitt from Laurier's Department of Geography and Environmental Studies – have since been joined by Drs. Sean Doherty and Robert Sharpe. Together they use the lab for 18 research projects, training three doctoral and nine master's students.

Faculty from four other universities – Université Laval, University of Waterloo, University of Toronto and University College London – are associated with the lab. Five researchers from federal and provincial government departments are also involved in research activities.

A sampling of the projects include:

- Spatial Distribution of Deer on Anticosti Island, Quebec
- Local Indicators for Categorical Data
- Recursive Voronoi Diagrams
- Spatial Distribution of Mountain Pine Beetle Attack on Lodgepole Pine in British Columbia
- Transdisciplinary Integration in Resource and Environmental Management
- Connections Between Information Technologies, Collaboration, and Regional Environmental Management
- Cumulative Impact Assessments In and Around Northern National Parks
- Information Management and the Grand River Basin
- Baseline Limnology and Nutrient Study of Basin Head Lagoon, Prince Edward Island
- Energy Balance and Arctic Tundra Hydrology, Coppermine River Basin, Northwest Territory
- Use of TOPMODEL in Delineating Flow Contributions from Groundwater and Soil Water in the Canadian Shield
- Trace Metal Distribution in Forest Soils Near Sudbury, Ontario.
- Snowmelt Hydrology In a Small Agricultural Catchment in southern Ontario
- Crime Analyses in the Region of Waterloo
- Spatial and Temporal Analysis of Human Travel Patterns

Wilfrid Laurier University

Multiple Metal Spectrometer

A multiple metal spectrometer – paid for, in part, by a $60,955 grant from the **Ontario Innovation Trust** – is essential for the training of both graduate and undergraduate students in metals-related research. It also helped earn Dr. Rick Playle his share of a Synergy Award for university-industry partnerships. More important still, it furthers his research into metals that can threaten fresh water.

The Atlantic cod or a Pacific tuna have no problem finding the salt they need to live; but it's harder for fish living in fresh water. Freshwater fish pull salt from the small amounts of sodium, chloride and calcium in the water. But fresh water can also contain metals such as copper, cadmium, aluminum, lead, mercury and silver – metals that can inhibit the uptake of sodium, chloride and calcium. A fish's gills cannot distinguish between such metallic elements as calcium and cadmium. The fish wants calcium, but if there is little in the water, it will instead take up metals. "Given enough time and a high enough concentration," says Dr. Playle, "metals can kill fish. At really high metal levels, the fish dies of suffocation."

In November, 2001, Dr. Playle and three colleagues from McMaster University and the Université de Québec, along with Kodak Canada Inc. and the Eastman Kodak Company of Rochester, N.Y., received a Synergy Award from the Natural Sciences and Engineering Research Council and The Conference Board of Canada. The purpose of the $25,000 Synergy Awards is to foster increased university-industry collaboration in research and development, and to showcase the benefits of pooling resources and making the most of Canada's technological expertise.

UNIVERSITY OF
WINDSOR

Invasion Threats to the Great Lakes

Professor Hugh MacIsaac, a researcher from the University of Windsor's Great Lakes Institute for Environmental Research (GLIER) received a PREA award in July 2000 for his research into the development of predictive models of invasions of species, such as the waterflea, in Ontario lakes and the Great Lakes.

Prof. Hugh MacIsaac's laboratory studies nonindigenous species in Ontario lakes. Since receipt of his PREA award, Dr. MacIsaac's lab has expanded to include significantly greater training of graduate students and postdoctoral fellows. Work in the lab that is presently supported by PREA includes projects designed to predict invasions by spiny waterfleas into inland lakes in the province, and those designed to assess the invasion risk of ships that enter the Great Lakes and discharge either fresh or saline ballast water. The PREA award has allowed Dr. MacIsaac to train two additional graduate students and two additional postdoctoral fellows per year. The waterflea project has determined that humans disperse the species to new lakes, the consequences of which are profound. Together with government and corporate participants, the ballast project has demonstrated that residual sediments in ballast tanks pose invasion threats to the Great Lakes, and that Lake Superior is at greatest risk.

Dr. MacIsaac, his graduate students and postdoctoral fellows are very grateful for the support from the PREA program.

UNIVERSITY OF WINDSOR

Making Drinking Water Safer

The University of Windsor first received funding from the **Ontario Innovation Trust** through the CFI Innovation Fund match program in 1999. Since this time, the University has witnessed a continual increase in the number of applications submitted to **OIT** as well as the number of successful awards granted. The **Ontario Innovation Trust** has not only provided the University of Windsor with the opportunity to enhance and improve the performance of research currently being conducted on campus but also allows the ability to expand research opportunities that continue to attract emerging researchers. The breadth of research being conducted at the University of Windsor has been significantly and positively impacted by the introduction of the **Ontario Innovation Trust**. Below we provide examples of how these awards have impacted our research community.

Principal Investigator, Dr. Stanley Reitsma received $200,000 for the project, "*Characterization, remediation and modelling of surface water and groundwater contamination.*" The impact that the infrastructure and the equipment that this project enabled the University to purchase has been very influential in training of highly qualified personnel as well as impacting the relationships between faculty members and departments. The equipment has given opportunity and training for students to become capable of working in an environmental laboratory and increased knowledge of environmental sampling techniques, analytical techniques and quality control issues. The computing facilities have given students the opportunity to use and experience high speed computing handling large simulation problems. This project expects and anticipates improved recruitment of graduate students in the future.

The impact of the infrastructure on the faculty at the University is also quite compelling. Projects have been established between biology and environmental engineering related to work on the Detroit River; equipment has been used in work with private sector industries including General Electric and DaimlerChrysler and the Detroit River project work is being done in conjunction with Environment Canada, the Ontario Ministry of the Environment, the City of Windsor and a number of public interest groups.

It is felt that the development of clean up technologies that are most cost effective and achieve clean up goals may lead to dramatic long-term cost savings and that the analytical equipment and computer facilities will be used to improve environmental quality of air, water and soil. Impact will be felt through development of management and remedial strategies, clean up technology and education.

Dr. Stanley Reitsma, Dept. of Civil and Environmental Engineering

UNIVERSITY OF
WINDSOR

Molecular Biogeochemistry at Windsor

Dr. David Fowle entitled, "*A Facility for the Study of Nanoscale Mineral-Bacteria-Contaminant-Water Interactions.*" This award was for approximately $200,000.

Dr. David Fowle received this grant to continue to explore new territory in environmental research.

"We do not know a great deal about the effects of bacteria and nanoscale minerals, which are extremely small mineral particles, on the mobility and bioavailability of toxic metals in our environments," says Dr. Fowle. "Bacteria may be used in collecting and helping to remove these trace metals from the environment, but they may also promote their spread through groundwater at faster rates than we would expect."

It was the very creation of this program that led Dr. Fowle to consider returning to Canada as a university researcher. Prior to the creation of this program, it was his opinion that there were only a select few Canadian universities with the resources to compete in the global market for top Canadian researchers; thus there was limited opportunity for faculty positions that included enough start-up funds for world class research facilities. Dr. Fowle's award will enable him to create a world-class biogeochemistry facility at the University of Windsor. And it is this facility that will help attract high quality graduate students and postdoctoral fellows to work with him in his laboratory. Clearly, without this award, his research would not be starting on the leading edge, but rather lagging behind. Dr. Fowle is quite thankful for this welcomed boost to the research infrastructure across Canada and to his young and very promising career.

Dr. David Fowle
Department of Earth Sciences &
Great Lakes Institute for Environmental Research (GLIER)

UNIVERSITY OF
WINDSOR

Studying Diseases and Aging

Principal Investigators Drs. Sirinart Ananvoranich and Siryiam Pandey, received $400,000 for their research project, "*Biochemical and proteomics facilities for the study of human diseases and aging using a cellular model system.*"

Principal Investigators **Drs. Sirinart Ananvoranich and Siyaram Pandey**, received $400,000 for their research project,"*Biochemical and proteomics facilities for the study of human diseases and aging using a cellular model system.*" Drs. Ananvoranich and Pandey have felt that the **OIT** award has significantly impacted their ability to perform and continue their research, as well as to accommodate and train a number of students.

This research facility will provide an excellent opportunity for the study of biochemical mechanisms behind diseases and for the discovery of new therapeutic targets. Futhermore, it will also be used as the platform to evaluate the efficacy of novel therapeutic compounds and their toxicity on mammalian neuronal, fibroblast, lymphoid and liver cells.

The funding from **OIT** has allowed their laboratory to acquire essential equipment. In the past few months they have purchased a phosphoImager, imaging systems, culture storage and incubators. These instruments have been used in the research and training of highly qualified personnel. Without the **OIT** award, their research efforts would have experienced delays. The instruments that were purchased have allowed them to produce very valuable preliminary data on the expression of delta ribozymes in the intracellular, *Toxoplasma gondii*. Over the next few months, the laboratories will be renovated and will be able to accommodate up to 12 more researchers and students. Presently they can handle 4 students. This renovation will give them the opportunity to equip their laboratory with state-of-the-art instruments for proteomics research as well as other medical biochemistry and related research.

Dr. Sirinart Ananvoranich
Department of Chemistry and Biochemistry

Dr. Siyaram Pandey
Department of Chemistry and Biochemistry

UNIVERSITY OF
WINDSOR

New Materials Research

Dr. Douglas Stephan of the University of Windsor's Department of Chemistry and Biochemistry was awarded $1.2 million from the **Ontario Research and Development Challenge Fund** for the "*Centre for Catalysis and Materials Research*".

The Centre for Catalysis and Materials Research was established as a research centre with both short- and long-term goals relating to production processes, properties and applications of new materials of interest to Ontario and Canadian industries.

Building on the presence of internationally recognized leaders in the fields of organometallic chemistry, supramolecular chemistry and solid state materials, the expertise of "The Centre" is broadening with the addition of new faculty, technicians, postdoctoral fellows, graduate students and undergraduate research assistants. This team of researchers is involved in leading-edge research that offers technologies fundamental to a competitive position in the marketplace of the new millennium. Training of students and postdoctoral fellows in these areas of research will provide the highly skilled workforce essential to Ontario industries for implementation of advanced technologies.

Dr. Douglas Stephan
Professor of Chemistry
NSERC/NOVA Chemicals Industrial Research Chair

UNIVERSITÉ YORK UNIVERSITY

Visual-motor Neuroscience

Dr. Crawford's research aims to understand how the brain perceives the world through vision and then uses this information to guide purposeful action. This relates to topics as diverse as perceiving scans across eye movements (like looking both ways to cross the street) to eye-hand co-ordination. The team usually begins with computer models of these processes, then rigorously tests the behaviours themselves, before undertaking more invasive testing of the neural substrates of these behaviours. Since so many parts of the brain are involved in these functions, it should not be surprising that most injuries and diseases of the brain affect visual-motor processing in some way.

The ripple effect of his research is significant. As Professor Crawford points out: "The OIT and CFI funding is being used to upgrade and expand my laboratory facilities to include cutting edge equipment and a combination of experimental techniques that can't be found anywhere else in the world." His laboratory is very active in the training of highly qualified personnel. Currently, there are seventeen researchers, including four Post-doctoral fellows from around the world, two Research Associates (M.D. and Ph.D.), and seven graduate students. They collaborate with investigators in Holland, Germany, and France. They also collaborate, through the York Centre for Vision Research and the CIHR group for action and perception, with researchers at Toronto, Laurier, and Western. This research field represents a major international strength for Ontario. Dr. Crawford has published extensively to share his results with others. Two highlights from 2001 were a paper in *Nature Neuroscience* and one in *Nature*.

This research has a beneficial effect on Ontario and beyond. It is intended to use the findings in the development of prosthetic devices which will one day aid the blind and paralysed. Diseases and Dysfunctions of the brain -- in the broad sense that includes both psychiatry and neurology -- represent the single largest cost to Ontarians in terms of both direct medical expense, loss of productivity, and loss in quality of life. As our populations ages, these problems only become worse. Dr. Crawford's research will provide the understanding, training, and technology that will allow our future clinical practitioners to deal with this unacceptable situation. Moreover, he is training future researchers, thus adding to the pool of expertise available in Ontario in this field of research.

Principal Investigator: J.D. Crawford, Canada Research Chair in Visuomotor Neuroscience, Centre for Vision Research, York University

Provincial Funding: PREA & OIT

UNIVERSITÉ YORK UNIVERSITY

CRESS Space Instrumentation Laboratory

The CRESS Space Instrumentation Laboratory (CSIL) is a facility in which concepts for space flight instruments are proven, designs are developed and tested, and flight systems are characterized. CSIL, together with government and industrial partners, supports the national space program. The associated research is primarily concerned with optical remote sensing of the atmosphere, in which measurements are made from satellites above the atmosphere, at around 600 km, requiring electro-optical instrumentation of a highly specialized nature.

For the Space Instrumentation Laboratory, the Canadian Space Agency was a sponsoring partner and the research team is working on projects with the Meteorological Service of Canada, EMS Technologies, the European Space Agency and the Japanese space agency called NASDA (National Aeronautics and Space Development Agency).

The ripple effect of his research is significant. Through CRESS, Dr. Shepherd has trained many future researchers who have gone on to work in universities, in government laboratories, or in industry. Some have started their own companies, for example, PhD Associates, Resonance Ltd., Advanced Subsystems, and Stellar Optics. He is co-leader of an international SCOSTEP project which involves a ground-based network of observatories around the world in seventeen countries, including several developing ones such as Indonesia, Vietnam, and Georgia. In the spacecraft projects his team has collaborated with the space agencies of four foreign companies: CNES (France), NASA (USA), ESA (Europe), and NASDA (Japan). His team supported the successful proposal for the CRESS Space Instrumentation Laboratory. He notes: "We created infrastructure through CRESTech for the support of a new technology which we developed: Doppler Michelson Interferometry." (CRESTech itself, as an Ontario Centre of Excellence, is a major success story in its support for collaboative research and its application of science and engineering to profitable new ventures.) It is the research team's hope that their technology will make it possible to improve long-range weather forecasts. In addition, through his more than 200 publications, he has made his findings available to other scientists who are also advancing research in our knowledge of space.

This research will continue to have a beneficial effect on Ontario through the development of new technologies and instrumentations. Already, CRESS is positioned to work with EMS Technologies to provide aerospace wind measuring instruments on a commercial basis. The first potential sale is for an instrument to be used by US scientists, and a proposal has been submitted to NASA for funding. While the nature of this project is best suited to teaming with established companies, one of the potential by-products of scientific work is the start up of new companies; for example, four former students have started companies based on related experiments and instrumentation.

Principal Investigator: Gordon Shepherd, Director, The CRESS Space Instrumentation Laboratory, York University

Provincial Funding: Centres of Excellence & OIT

UNIVERSITÉ YORK UNIVERSITY

Analytical Mass Spectrometry

The specialized infrastructure funding, awarded for Professor Siu to build two prototype mass spectrometers, computers and workstations for quantum mechanical calculations of ion structures and energetics, has helped establish York University as a leading institution for the training of analytical and biological mass spectrometry. The research centres around analytical and biological mass spectrometry. The research accomplishments include (a) developing with MDS SCIEX (a leading mass spectrometer manufacturer) a segmented quadruple cell for ion-mobility measurements that is used for probing structures of protonated and metallated gas-phase biological ions, and (b) developing with Barringer Research (a leading ion-mobility spectrometer manufacturer) electrospray introduction for ion-mobility spectrometry and interfacing it to mass spectrometry, and (c) working with Eli Lilly to develop new analytical techniques for quantifying drug molecules.

The ripple effect of Dr. Siu's research is significant. The results of the above research have led to one pending patent and 30 scientific papers in peer reviewed journals; thus other scientists have access to his findings. He has ensured a high degree of training for members of his team and for graduate students, who are sought after by industry and academia. He reports, for example, "Three former associates are currently research and application scientists at MDS SCIEX, another is a research scientist at Apotex, while a fifth one is now an assistant professor at the Okanagan University College. Three of my former research assistants are currently technical officers and mass spectrometrists at the National Research Council, Mount Sinai Hospital and Syn-X Pharma. Undergraduate students who have worked with me in their honours thesis work have also found work in the mass spectrometry field: one former student is now at MDS Proteomics and another was with the Ontario Ministry of the Environment prior to her relocation to Australia."

This research has a beneficial effect on Ontario. Professor Siu's research has strengthened the research capabilities of his collaborators, MDS SCIEX, Barringer Research and Eli Lilly and, as noted above, the results of some of these collaborations have been commercially exploited. His former associates have become key employees of these and other industries.

Principal Investigator: K.W. Michael Siu, Director, Centre for Research on Mass Spectrometry
York University

Provincial Funding: ORDCF & OIT

UNIVERSITÉ YORK UNIVERSITY

Medicinally Important Compounds

Professor Michael G. Organ is the founder and director of the Combinatorial Chemistry Facility at York University. Since 1994, Dr. Organ's research has focused on synthetic efficiency and more specifically on the application of tandem-reaction methodology to improve synthetic efficiency.

While initial studies have been concerned with methods development, progress has allowed Dr. Organ's group to undertake the synthesis of a number of natural product targets. Further, progress in tandem-reaction chemistry involving heteroatoms has also allowed Dr. Organ's group to initiate a program in the synthesis of pharmaceutically relevant compounds. This latest initiative has resulted in the formation of collaborative projects with a number of pharmaceutical and instrumentation companies, many of which are active members of the Combinatorial Facility at York. This facility is fully equipped with all the leading edge synthetic and analytical facilities to prepare libraries of potential drug leads. This facility serves not only Dr. Organ's group and other academicians, but a number of start-up and more established companies as well.

The ripple effect of his research is significant. First, he has built the Ontario Combinatorial Chemistry Library Facility at York. Second, he has an international reputation: he is now the American Chemical Society's representative to teach short courses on combi-chem to a global audience of both academicians and scientists from industry; he has taught in the United States, Ireland, Switzerland, and Japan; he is a selected member of the *Journal of Combinatorial Chemistry* advisory board. Third, he has established collaborative relationships with many companies and researchers. He consults for a number of companies and collaborates directly with many others. Fourth, Dr. Organ has published eleven papers since winning the ORDCF award and submitted four articles for publication. He has also written one chapter in a book on combinatorial chemistry. Fifth, he has mentored nineteen post-doctoral fellows, seven graduate students, and three undergraduates. All are actively engaged in research in industry relating to this area of chemistry.

His research has a beneficial effect on Ontario. Dr. Organ has developed his research into two spin-off companies. The first, Total Synthesis Ltd. prepares libraries of compounds (usually lead development) for commercial application. The second, York Bioanalytical Laboratories handles high-throughput analytical chemistry. It has provided the platform for three new companies and the potential for a major industry on the horizon. He is training highly skilled researchers, who enlarge our pool of expertise in combinatorial chemistry.

Principal Investigator: Professor Michael G. Organ, York University

Provincial Funding: ORDCF & PREA

UNIVERSITÉ YORK UNIVERSITY

Regulation of Genes

The regulation of genes controlling blood vessel growth has very profound implications for cancer and heart disease research. New blood vessel development is a necessary component of repairing heart muscle damaged by heart attack, or skeletal muscle damaged by peripheral vascular disease. Inhibiting blood vessel growth helps to control the growth of cancerous tumours. This research program involves identification of genes that are necessary for the initiation of blood vessel growth. Once genes are identified, Dr. Haas analyzes the specific factors or events that control their production. By studying the regulation of specific genes that are essential for the initiation of this process, she will gain a better understanding of how we can manipulate blood vessel growth therapeutically.

The ripple effect of Dr. Haas' research is significant. First, cardiovascular diseases are the leading cause of hospitalization for men over 45 and women over 55. It is the leading cause of death for over one third of Canadians. She is training highly skilled researchers in this field of study that is enormously relevant to today's health problems. They have learned to utilize state of the art technologies, thus helping to contribute to the long term viability and competitiveness of health research in Ontario, thus ensuring that the researchers required in the future are available.

Second, the equipment available to Dr. Haas now through **OIT** funding is expanding her opportunities for collaboration. She points out: "The equipment available to me now through CFI and **OIT** funding is expanding my opportunities for collaboration, for example, I am currently collaborating with Dr. Unthank in Indiana to study the role of matrix metalloproteinases and extracellular matrix alterations in arterial remodelling." Moreover, she is using this equipment in a way that no other investigator in the field has tried; thus, her application of these techniques is novel and has the potential to uncover previously unexplored avenues of research.

Third, she shares her findings with other researchers through a review article in press: "Molecular control of capillary growth in skeletal muscle" for *The Canadian Journal of Applied Physiology* and a research article in preparation: "Differential regulation of matrix metalloproteinases and VEGF during muscle stretch-versus shear stress-induced angiogenesis".

Her research has a beneficial effect on Ontarians. She is training highly skilled researchers, who enlarge our pool of expertise in cardiovascular disease research. She is collaborating with leading researchers elsewhere, thus enlarging her knowledge and influence in this research field. The knowledge gained, regarding control of blood vessel growth, can be applied to developing improved therapies for treatment of heart disease and cancer within the next 5-15 years.

Principal Investigator: Tara Haas, York University

Provincial Funding: PREA & OIT